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VOLUME 44 NOVEMBER 1946 NUMBER 5

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SARCOMA OF THE LARYNX

Report of Eight Cases

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PHILADELPHIA

THE FREQUENCY of sarcoma of the larynx based on cases reported during the past two decades would indicate that it is uncommon, although earlier writers believed that it formed about 10 per cent of malignant neoplasms. In Havens and Parkhill's [1] studies of laryngeal tumors observed at the Mayo Clinic for a period of thirty years, the ratio of sarcoma to carcinoma was 1 to 100. Eleven cases of sarcoma were observed during this period. In a review of malignant tumors of the larynx observed at the Jefferson Hospital since 1930, there were 8 cases of sarcoma and 740 cases of carcinoma, a ratio of 1 to 92. Since Havens and Parkhill's report 7 additional cases of sarcoma of the larynx have been added to the literature, as follows: Baldenweck and Leroux-Robert,[2] reticulosarcoma in a woman aged 76 years; Rigby and Holinger,[3] fibrosarcoma in a male infant aged 17 days; Gonzalez Loza and his associates,[4] fibrosarcoma in a woman aged 28 years; Ferguson,[5] 2 cases of fibrosarcoma in men aged 65 and 69 years; Foster,[6] fibrosarcoma in a man aged 31 years, and Glick,[7] rhabdomyomyxosarcoma in a boy aged 10 years.

Sarcoma is a disease of adult life and is commoner in men. In the 8 cases which constitute the basis for this report, all patients were

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Read at the meeting of the Eastern Section of American Laryngological, Rhinological and Otological Society, Inc., Boston, Jan. 9, 1946.

1. Havens, F. Z., and Parkhill, E. M.: Tumors of the Larynx Other Than Squamous Cell Epithelioma, Arch. Otolaryng. **34**:1113 (Dec.) 1941.

2. Baldenweck, L., and Leroux-Robert, J.: A Case of Reticulosarcoma of the Larynx, Ann. d'oto-laryng., April-June 1942, pp. 94-95.

3. Rigby, R. G., and Holinger, P. H.: Fibrosarcoma of the Larynx in an Infant, Arch. Otolaryng. **37**:425 (March) 1943.

4. Gonzalez Loza, M.; Imhoff, D., and Fernandaz Rodriguez, A. D.: Primary Sarcoma of Larynx: Endoscopic Extirpation, Rev. otorrinolaring. d. litoral **2**:458 (Dec.) 1943.

5. Ferguson, G. B.: Sarcoma of the Larynx, Arch. Otolaryng. **38**:265 (Sept.) 1943.

6. Foster, J. H.: Fibrosarcoma of Larynx, Ann. Otol., Rhin. & Laryng. **53**:764 (Dec.) 1944.

7. Glick, H. N.: An Unusual Neoplasm in the Larynx of a Child (Rhabdomyomyxosarcoma), Ann. Otol., Rhin. & Laryng. **53**:699 (Dec.) 1944.

men. The ages varied from 25 to 75 years, with 5 patients in the fifties and 1 patient of 49 years. One of these patients (case 4) had been observed and treated, however, thirty years previously for a similar lesion, at which time he was 21 years.

Although many histologic varieties may involve the larynx, the commonest form is fibrosarcoma. Ewing stated that this commonly involves the vocal cords and the epiglottis. The tumor is single, often is pedunculated, may be more or less nodular, is firm in consistency, usually is not ulcerated and is relatively avascular. The visible portion of the tumor may be large, but, if pedunculated, the point of attachment is not extensive and frequently can be removed readily without sacrifice of the larynx. Fibrosarcoma does not metastasize early and usually grows slowly, but local recurrences are observed if the primary lesion is not removed completely. The rapidity of growth varies; local recurrences may grow more rapidly than the primary lesion.

In this series there were 4 cases of fibrosarcoma. All the tumors were attached to a vocal cord, two being pedunculated. Of the remaining four, there was one each of fibro-osteosarcoma, chondrosarcoma, lymphosarcoma and extramedullary plasmocytoma.

SYMPTOMS

The symptoms of sarcoma are those common to all laryngeal neoplasms and depend on the location and size of the tumor. Hoarseness is a common early symptom and was observed in 7 cases. Dyspnea usually occurs late and in the large cordal lesions is progressive. In the pedunculated forms it may be intermittent, at times becoming alarming. These tumors may rapidly increase in size owing either to increased growth or to inflammatory changes.

DIAGNOSIS

The diagnosis often is not easy. The pedunculated form may be confused with an inflamed fibroma. The absence of ulceration suggests a benign tumor. Biopsy often is not satisfactory, as the overlying mucosa may be normal. Increasing dyspnea indicative of rapid enlargement and the absence of ulceration should suggest sarcoma. The appearances are not sufficiently typical to warrant a clinical diagnosis, and repeated biopsies may be necessary.

In 3 of the cases the first biopsy specimen was positive for sarcoma; in a fourth case the report of the first biopsy, which included all of the mass from the surface of the vocal cord, was fibroma. There was prompt recurrence, and a second biopsy specimen revealed fibrosarcoma. In 1 case the entire pedunculated mass, which suggested an inflammatory polyp, interfered seriously with respiration and was removed with

a snare. The histologic diagnosis was sarcoma. In 2 cases removal of the growth elsewhere provided sufficient tissue for study and led to a diagnosis of sarcoma. In the remaining case a clinical diagnosis of osteochondroma was made, but on histologic examination of the tumor following its removal the diagnosis was changed to fibro-osteosarcoma (case 4).

TREATMENT

Figi[8] well stated that the "treatment of sarcoma of the larynx depends on its size, situation and activity. Since many of these tumors are pedunculated, show less tendency to infiltrate the laryngeal structures and metastasize later than do carcinomas of the larynx, they may remain operable for a considerably longer period. . . . Thyrotomy is especially useful in the treatment of sarcoma of the larynx."

As in all malignant neoplasms, irradiation therapy has been attempted in sarcoma of structures other than the larynx. Tumors

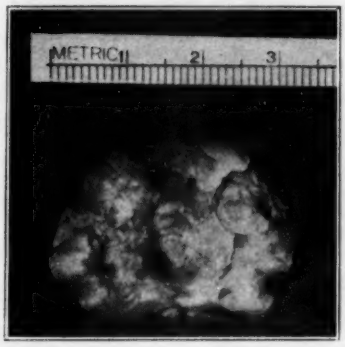

Fig. 1.—A lobulated, pedunculated mass removed with a snare from its attachment to the right arytenoid. The diagnosis was extramedullary plasmocytoma.

containing bone, cartilage or large amounts of fibrous elements do not respond well. Lymphosarcoma usually responds favorably, and irradiation was employed successfully in 1 case. The plasmocytoma was removed surgically, and the effects of irradiation could not be determined.

The patients in this group were treated as follows: In 2 cases laryngectomy was performed. These included a chondrosarcoma and a fibro-osteosarcoma. In 3 the tumor was removed adequately by thyrotomy. One patient was treated by removal of the attachment of the pedunculated growth together with a portion of the arytenoid with a snare. A discrete cordal tumor attached by a small pedicle was removed with a segment of the vocal cord by cupped and tissue forceps. The patient with lymphosarcoma was treated by irradiation.

8. Figi, F. A.: Sarcoma of Larynx, Arch. Otolaryng. **18**:21 (July) 1933.

REPORT OF CASES

CASE 1.—A man aged 58 years was observed during September 1930. There was hoarseness of six months' duration. A large, globular yellowish mass was found resting on the vocal cord, obstructing the anterior one half of the laryngeal

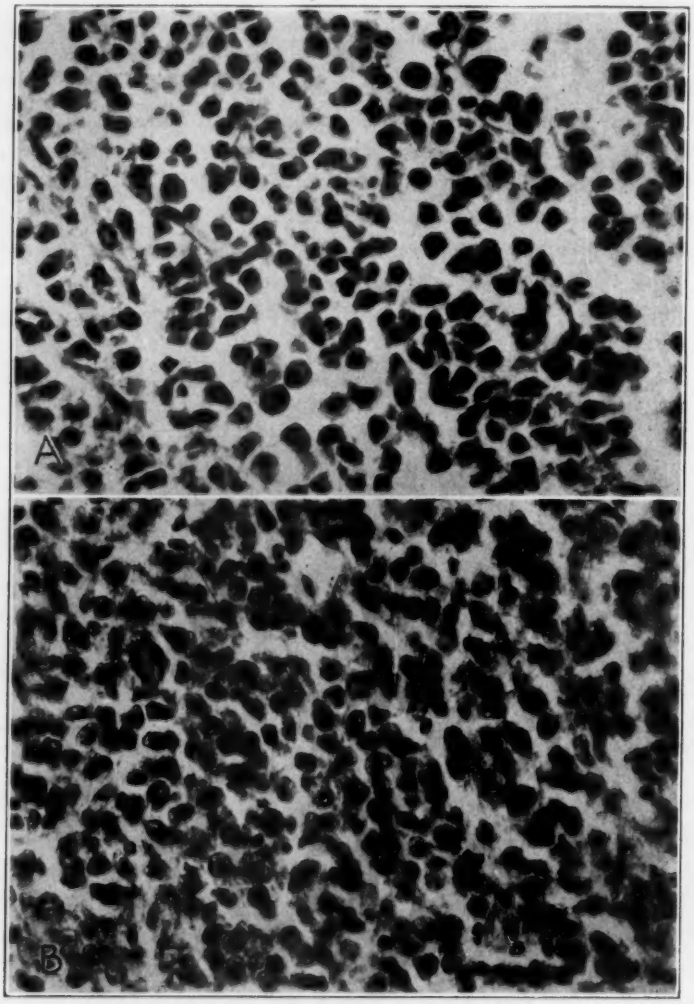

Fig. 2.—*A*, extramedullary plasmocytoma. The cells are fairly uniform in shape, with eccentrically placed nuclei. The nuclear chromatin has a radial arrangement. There also are a few large cells with deep-staining nuclei (× 400) (C. J. Bucher). *B*, lymphosarcoma of larynx. The tumor consists of a delicate reticulum and many small cells, with a scant cytoplasm and round deep-staining nuclei. These resemble lymphocytes (× 400) (C. J. Bucher).

cavity. The report of biopsy was fibrosarcoma. The growth and the vocal cord were removed by thyrotomy. Death occurred five and one-half years later from a cerebral accident. There was no recurrence of the sarcoma.

CASE 2.—A man aged 75 years was observed during June 1934. Huskiness and choking sensations with severe intermittent dyspnea had been present for eight weeks. A large, rounded, lobulated, pedunculated, inflammatory mass was found filling the laryngeal cavity, interfering with a satisfactory view of the vocal cords. The point of attachment of the growth could not be determined. By direct laryngoscopy it was found attached to the anterior surface of the right arytenoid near its tip. The appearances suggested an inflamed polyp. The entire mass together with its point of attachment and a considerable portion of the right arytenoid was removed with a snare (fig. 1). The histologic diagnosis was extramedullary plasmocytoma (fig. 2*A*). In view of this appropriate studies were carried out, but no tumors were found elsewhere. There was no recurrence of the growth for thirteen months, when the patient died from a cerebral hemorrhage.

CASE 3.—A man aged 49 years was observed during July 1934. The voice was muffled, and there was a sensation of a lump in the throat for six months. An ulcerated mass was found involving the left half of the posterior surface of the epiglottis extending along the left aryepiglottic fold. No lymph nodes were palpable. The appearances suggested carcinoma. The report of biopsy was lymphosarcoma (fig. 2*B*). Irradiation therapy was instituted by Dr. W. F. Manges. A total of 1,930 units was given to each side of the neck. The lesion disappeared promptly, and the larynx appeared practically normal. There has been no recurrence, and the patient is well.

CASE 4.—A man aged 51 years was observed during July 1935. In 1904 a growth was removed from the larynx by Dr. Joseph Hearn, on the service of Dr. W. W. Keen. The exact site could not be determined, but it apparently was an epiglottic lesion. The pathologic diagnosis by Dr. W. M. L. Coplin was sarcoma. In 1924 hoarseness again developed, and the patient consulted Dr. Curtis Eves, who removed a growth. A record of this was not available. Hoarseness continued, and eleven years later, during 1935, dyspnea developed, which became rapidly worse. The larynx could not be visualized because of the presence of a large, rounded, superficially ulcerated mass which filled the entire laryngopharynx. A clinical diagnosis of osteochondroma was made, tracheotomy was performed and an attempt was made to remove the tumor by transhyoid pharyngotomy. Its extent prohibited this, and laryngectomy was performed (fig. 3). The histologic diagnosis was fibro-osteosarcoma. There was recurrence of the growth in the wound and the report of a biopsy was fibrosarcoma. Irradiation therapy was instituted, without benefit. An unsuccessful attempt was made to resect the growth. From this point there was rapid extension of the growth to both sides of the neck and later to the lungs. Death occurred fourteen months after admission. At autopsy innumerable, variously sized, firm nodules were found distributed through both lungs, more in the right. There was no other evidence of metastasis. The histologic diagnosis of metastatic lesions was fibroangio-osteosarcoma.

CASE 5.—A man aged 55 years was observed during September 1936. There was hoarseness of eleven months' duration, with slight cough. A large, red, smooth, sessile mass was found involving the entire membranous portion of the left vocal cord, extending upward, elevating the ventricular band and extending subglottically for a short distance. It was not ulcerated. Removal was carried out with cupped forceps, and the histologic diagnosis was fibroma. There was prompt recurrence, and a second biopsy specimen revealed fibrosarcoma. The growth, including the entire left vocal cord and subglottic tissues, was removed by thyrotomy. The patient died nine and one-half years later from a heart attack. There was no recurrence of sarcoma.

CASE 6.—A man aged 58 years was observed during August 1940. There was hoarseness of one month's duration. A rounded, globular, smooth, nonulcerated lesion about 1 cm. in diameter was observed resting on the upper surface of both cords in their anterior half. There was no interference with approximation of the cords. By direct laryngoscopy it was found to be attached by a small pedicle to the edge and upper surface of the left cord. The entire growth together with the pedicle and its point of attachment, including some of the vocal cord, was removed with cupped forceps. The report of biopsy was fibrosarcoma. There has been no recurrence for over five years.

CASE 7.—A man aged 25 years was observed during July 1945. There was hoarseness for more than two years. A rounded, fusiform mass was found occupy-

Fig. 3.—Posterior view of larynx, with signet of cricoid cartilage divided, and large multilobulated tumor which was found springing from epiglottis, left aryepiglottic fold and ventricular band. The large mass completely obscured a view of the larynx and the other nodules.

ing the right side of the larynx at the location of the vocal cord. It extended from the anterior commissure to the tip of the vocal process of the arytenoid and extended subglottically. It was not ulcerated. Along its upper edge there was a small purplish varix-like elevation. There was no fixation of the arytenoid. No lymphadenopathy was present. Prior to admission a biopsy was done elsewhere, and a diagnosis of sarcoma was made but this later was changed to fibroma. Two removals of the growth were carried out under suspension laryngoscopy. At the first removal, the growth was removed and a diagnosis of fibrosarcoma was made.

The lesion recurred, and at the second laryngoscopy the growth and vocal cord were removed. When admitted on July 6, 1945, no biopsy was made, as the reports secured from previous removals indicated that the tumor was sarcoma (fig. 4). Thyrotomy was performed and the tumor inspected. It appeared to be well circumscribed, so that the entire growth together with the tip of the arytenoid and an ample margin of surrounding normal tissue was removed (fig. 5). Recurring

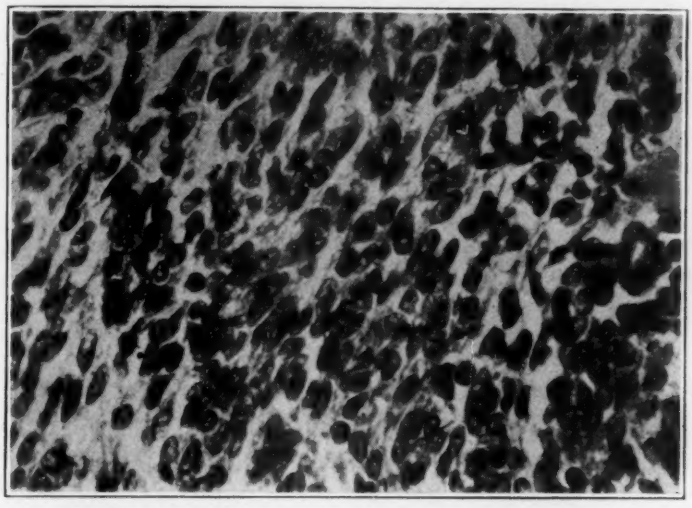

Fig. 4.—Spindle cell sarcoma of larynx. The tumor is composed of bundles of cells resembling young fibrous tissue. The nuclei of these are spindle shaped and are somewhat vesicular. Considerable vascularity was noted (× 400) (C. J. Bucher).

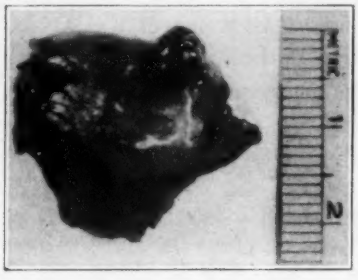

Fig. 5.—Mass of tissue representing fibrosarcoma, with an ample margin of surrounding normal tissue removed by thyrotomy. The lesion appeared sharply circumscribed and did not appear to be adherent to the thyroid cartilage. A small purple varix-like elevation was observed on its upper surface.

masses of granulations were removed on several occasions, but the larynx is now epithelized and there has been no recurrence.

Case 8.—A man aged 55 years was observed during July 1945. There was hoarseness for one year and dyspnea for two years. Laryngofissure had been performed elsewhere on the assumption that the patient had carcinoma. Because of recurrence of the lesion the tissue was reexamined, and a diagnosis of chondro-

sarcoma was made. There was a large, rounded, smooth mass involving the left side of the larynx below the level of the vocal cords, producing subglottic stenosis. There was no ulceration. In addition to the encroachment on the tracheal airway, there was an extension of the mass into the left pyriform sinus. Because of the previous laryngofissure and the present extent of the lesion, a laryngectomy was performed. There has been no recurrence to date.

END RESULTS

Of the 6 patients observed more than five years ago, 1 died from sarcoma which recurred locally and metastasized to the lungs. Two died of cardiovascular disease, five and one-half and nine and one-half years postoperatively, without evidence of recurrence of sarcoma. One died of cerebral hemorrhage thirteen months after operation, with no local evidence of recurrence. Two are living and free from recurrence over five and eleven years following operation. In 2 the postoperative interval is only five months, and too little time has elapsed to evaluate the results.

COMMENT

On the basis of a study of reported cases and personal experiences, it would appear that fibrosarcoma of the larynx should be treated surgically and that complete removal is necessary. A majority of these can be removed without sacrifice of the larynx. An open operation is desirable unless the tumor is pedunculated.

The location and extent of the growth and the previous surgical intervention in the case of chondrosarcoma prohibited removal as practiced by New [9] in his case, and laryngectomy was done.

Experience with lymphosarcoma of the larynx is limited. It is the opinion that irradiation is the treatment of choice.

Although sarcoma is a rare neoplasm in the larynx, it should be considered in diagnosis.

1530 Locust Street.

9. New, G. B.: Sarcoma of Larynx: Report of Two Cases, Arch. Otolaryng. **21**:648 (June) 1935.

SIGNIFICANCE OF DEEP EPIDURAL ABSCESSES IN PATHOGENESIS OF OTOGENIC ABSCESSES OF THE BRAIN

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THE clinical and pathologic aspects of otogenic abscesses of the brain have already been widely and thoroughly discussed. Among the various pathologic conditions which may cause them, deep epidural abscesses resulting from perilabyrinthine suppurations deserve particular interest. This is seen clearly in the 3 cases reported in this paper, in which the abscesses showed unusual diagnostic and pathogenetic features. All the cases ended fatally, and the brain and temporal bones were available for histologic examination.

REPORT OF CASES

CASE 1.—W. B., a man 25 years old, was admitted to the Neurological Institute of New York on Aug. 30, 1938. At the age of 8, he had suffered from right-sided acute otitis media following scarlet fever, with discharge from the ear for one week. Since that time he had not had any complaints regarding his ear. In January 1938, he had severe bilateral frontal headaches off and on for one week. In May 1938, he had similar headaches for one week, together with a gradually developing weakness of the left arm and leg, which ceased after a few days. The temperature was elevated to 105 F. during this episode and was associated with delirium and incontinence. Five days before admission the patient began to have similar bouts of headaches, more pronounced on the right side and radiating back to the neck. The first few days the temperature was elevated to 100 to 102 F.

Physical Examination.—The general physical examination did not show any abnormal findings. The neurologic examination showed an inconstant slight hyperreflexia of the left upper and lower extremities; the abdominal reflexes on the left side were less pronounced than the ones on the right. There was a questionable slight left-sided facial weakness (emotional) and a tendency to irritability, mental dulness and euphoria. Examination of the eyes showed slight haziness of the nasal margin of the left disk. Examination of the ears showed normal drums and normal hearing in both ears.

The authors were assisted by grants from the Research Council of the American Otological Society and the Hayden Coakley Fund.

From the Department of Otolaryngology of the Columbia University College of Physicians and Surgeons and the Presbyterian Hospital, New York.

Laboratory Findings: The red blood cell count was normal, the hemoglobin content was normal and the white blood cell count was 13,500, with 77 per cent polymorphonuclears, 22 per cent lymphocytes and 1 per cent monocytes. The sedimentation rate was 2 mm. per hour. The blood chemistry was normal; the Wassermann reaction was negative, and the urine was normal. Spinal fluid showed an initial pressure of 105 mm. and 208 mm. on two examinations. There was a large number of red blood cells in the fluid due to trauma at the first puncture, which made the evaluation of the findings difficult. There was an increased number of white blood cells in the fluid, with a predominance of lymphocytes and an elevation in the protein content.

Course.—During his stay in the hospital, the patient continued to have a slightly elevated temperature (around 99 F.), the pulse rate was 80 and the respiratory rate around 20. The blood pressure was from 110 systolic and 76 diastolic to 120 systolic and 88 diastolic. The headaches gradually disappeared, but sharp pains in the neck developed, which radiated up into the head. The neurologic examination remained noncontributory except for tenderness of the neck muscles. Mentally, the patient was negativistic, withdrawn and shy at times and at others aggressive. The patient died suddenly three weeks after admission to the hospital.

Autopsy.—Autopsy showed a large abscess in the right temporal lobe of the brain. The dura overlying the lesion was adherent to the surface of the temporal lobe and to the surface of the petrous portion of the right temporal bone, which contained an area of erosion beneath the dura. There was a decided herniation of the cerebellar tonsils into the foramen magnum. Culture from the abscess of the brain showed hemolytic streptococci. Histologic examination showed the wall of the abscess fairly well developed and consisting of connective tissue without glial proliferation. There were a number of smaller abscesses within the wall of the large abscess, but others were external to it and had a lesser amount of connective tissue in their walls. Gram stains showed occasional chains of gram-positive cocci in the contents of the abscess.

Histologic Examination of the Temporal Bones (horizontal serial sections).—Right Temporal Bone: The external canal and drum were normal.

Middle Ear. The mucosa was thin and lined with one layer of cuboidal epithelium. The ossicles were intact and the window niches almost free from strands of organized tissue. The antrum was wide and free from any exudate. The petrous tip consisted of diploic bone with hematopoietic and fat marrow. There were a few small peritubal cells.

Mastoid. The mastoid was only partially contained in the sections. The pneumatization was impeded, the cells irregular in size and irregularly arranged and the intercellular septums thicker than normal. The cells were lined with slightly hyperplastic mucosa and were free from acute inflammatory changes. In the wall of some of the cells a small amount of newly deposited bone was seen. The perilabyrinthine cells were poorly developed and did not extend forward beyond the level of the superior vertical canal. Immediately in front of these cells a large epidural abscess was situated, which extended forward along the posterior surface of the petrous pyramid over the roof of the internal auditory meatus and over the petrous ridge to the upper surface of the bone into the neighborhood of the impressio trigemini. The cavity had a maximum length of 22 mm., a maximum width of 7.5 mm. and a height of 5 to 6 mm. The superior petrosal sinus was free from pathologic changes. The abscess cavity was filled with

pus and contained one big and several smaller bony sequestrums (fig. 1). It was lined with a thick layer of granulation tissue. The underlying bone was deeply eroded, particularly in the region of the petrous ridge. In the posterior parts of the abscess some erosion of the bony wall, with formation of minute sequestrums, was still going on, but otherwise the process had come to a standstill and neither bone destruction nor apposition was seen. The marrow spaces in the immediate neighborhood of the abscess cavity showed a heavy inflammatory infiltration, but a short distance away from the cavity their appearance was normal. The

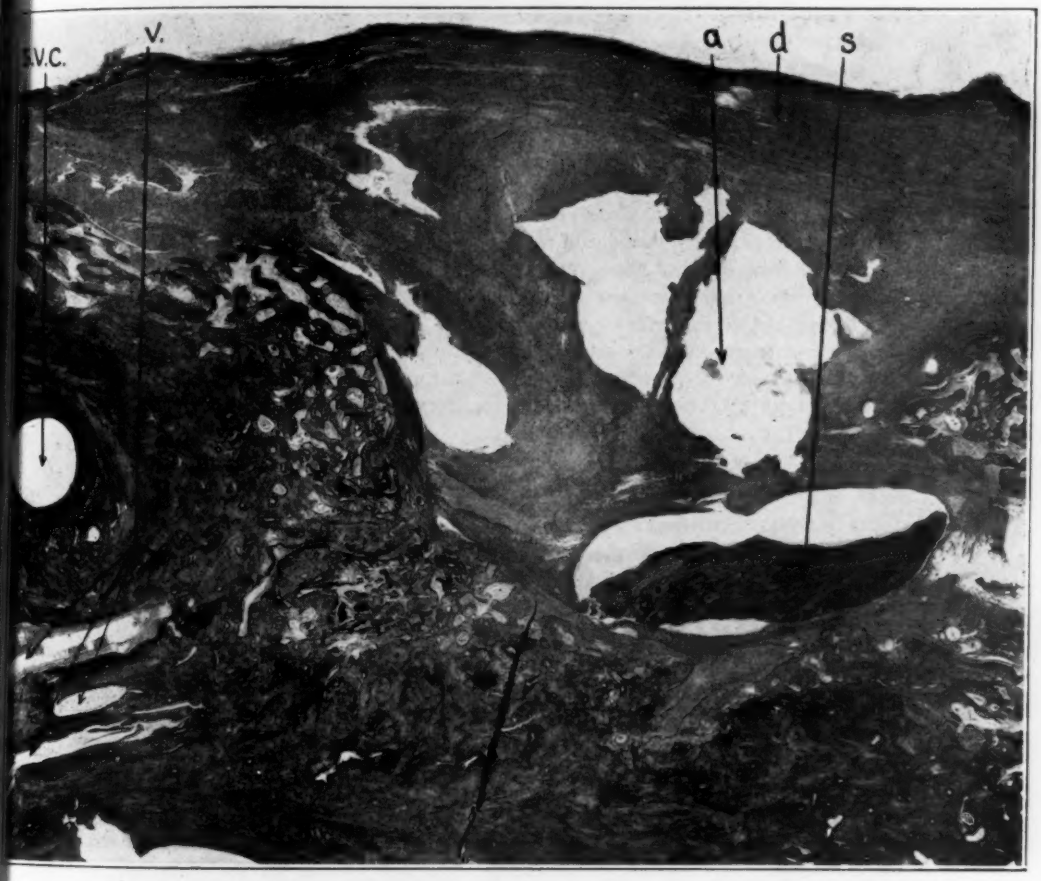

Fig. 1 (case 1).—Epidural abscess containing a big bony sequestrum: *a* indicates abscess; *s*, sequestrum; *s.v.c.*, superior vertical canal; *v*, blood vessels running through the concavity of the superior vertical canal into the tip, and, *d*, dura of the posterior fossa.

pneumatic cells adjacent to the posterior pole of the abscess showed moderate chronic inflammatory changes. Numerous vessels traversed the thin mass of diploic bone which separated the cells from the abscess cavity and connected the vascular system of the cells with that of the abscess cavity and of the overlying dura. Some of the vessels ran through the bone in the concavity of the

superior vertical canal into the tip. In the neighborhood of the abscess the perivascular tissue became increasingly more heavily infiltrated with inflammatory cells. The outer surface of the dura was covered with a thick layer of granulation tissue, which formed the wall of the abscess cavity. The dura itself was thickened and showed perivascular round cell infiltration. On the internal surface of the dura, there was a loose-meshed connective tissue with a heavy infiltration of round cells. The underlying leptomeninges were moderately thickened and infiltrated. The deeper portion of the cerebral cortex present in the sections showed a mild loss of ganglionic cells and some thickening of the walls of the cortical vessels, with occasional perivascular and mural infiltration of round cells.

Inner Ear and Internal Auditory Meatus: The inner ear and internal meatus were free from pathologic changes.

Left Temporal Bone.—There were no pathologic changes. The mastoid process and the tip were well pneumatized. The perilabyrinthine cells were well developed.

Summary.—A man 25 years of age had suffered, at the age of 8, from a right-sided acute otitis media, following scarlet fever, of one week's duration. Since that time he had had no complaints relating to his ear whatsoever. Seventeen years later he died of an abscess of the right-sided temporal lobe, after having had cerebral symptoms on and off for about nine months. The abscess had developed from a deep-seated epidural abscess of the posterior fossa, which had extended around the petrous ridge into the middle fossa and here penetrated through the dura. The middle ear was found entirely free from acute or chronic inflammatory changes.

Case 2.—O. Celia, 36 years old had had scarlet fever at the age of 12, followed by continuous discharge from the right ear, with pronounced deafness and occasional tinnitus. Four years before, the discharge stopped, and she began to have occasional headaches, particularly before her menstrual periods. At times the headaches were accompanied with nausea and vomiting and at other times with vertigo. The headaches gradually increased in severity. Late in 1936 the headaches became severe and the attacks of dizziness frequent.

The patient was first seen in the Ear, Nose and Throat Department of the Vanderbilt Clinic on Dec. 23, 1936.

Examination at that time showed the right external auditory meatus narrow; the drum showed a moderately large, dry perforation in the anterior-inferior quadrant. The left meatus and drum were normal. There was a septal deflection to the right; the other findings in the nose and throat were normal.

The right ear was completely deaf, and the hearing on the left was unimpaired. Roentgenologic examination of the temporal bones showed on the right side a sclerotic mastoid, with the antrum not well visualized: on the left side the mastoid was well pneumatized and the antrum clearly visible.

In the beginning of January 1937, the attacks of dizziness and nausea became so severe that the patient had to stay in bed for a week. She noticed a weakness in the right arm and a tendency to mix up words and to mumble her speech.

The symptoms disappeared after two weeks, with exception of a slight ataxia in gait. The fundi of the eyes were normal.

In the course of the year, she had several spells of occipital headache associated with brief episodes of dizziness and nausea. About once every two months she noticed a weakness in the right arm, lasting for perhaps a day at a time.

In the first days of April 1938, the patient began to have daily attacks of severe headaches, with nausea, vomiting and dizziness. At the same time the weakness in the right arm came back.

The patient was admitted to Presbyterian Hospital on April 14, 1938. Examination showed an acute exacerbation of chronic suppuration of the middle ear on the right side. There were complete deafness and loss of the vestibular response in the right ear.

The neurologic examination showed striking mental dulness and slurring and poor articulation of the speech. There was a slow horizontal nystagmus when the patient looked to the right side and a slight weakness of the right facial nerve. Examination of the eyes showed the margins of the optic disks slightly blurred and the veins engorged. There was a weakness of the right upper extremity, with ataxia and adiadokokinesis.

A right-sided cerebellar abscess was suspected, and the patient was transferred to the Neurological Institute of New York for further observation. There she died suddenly on April 25, 1938.

Autopsy.—Autopsy showed the right cerebellar hemisphere enlarged. Its lateral margins were attached through firm fibrous adhesions to the posterior surface of the petrous pyramid in the region of the endolymphatic sac. The right cerebellar hemisphere contained two abscesses. One was superficially located immediately underneath the just described fibrous masses and indented the folia slightly; the other one was larger, measuring 2.5 by 2.5 cm., and lay at the junction of the central white matter and the folia. It involved the nucleus dentatus and extended with a tonguelike projection into the right half of the vermis. Both abscesses contained pus with hemolytic streptococci and were lined with a well developed capsule. The latter, in the superficial abscess, was composed of connective tissue, with a pronounced glial proliferation in the adjacent areas; in the deep abscess, it consisted of granulation tissue and the glial proliferation was less extreme. There were a decided pressure cone and a recent hemorrhage into the cisterna magna.

The histologic examination of the temporal bones (horizontal serial sections) showed the following changes:

Right Temporal Bone.—External Auditory Meatus and Drum Membrane: The osseous walls of the external auditory meatus were slightly hyperostotic and the lumen somewhat narrowed. The drum membrane was replaced by a "neomembrane," which occupied approximately the same position as the former but did not show its characteristic inclination and declination (fig. 2). Its surface was almost perpendicular to the long axis of the innermost part of the external meatus, and there was no recessus between the anterior and inferior meatal walls and the membrane. The neomembrane consisted of connective tissue with a slight round cell infiltration and was covered on its outer surface with a thin dermoid layer and on its inner surface with a thin mucosal layer. Its greatest diameter was 4.5 mm. In its central part, there was a round perforation, with a maximum diameter of about 1.5 mm. The mucosal layer was lined with pseudostratified ciliated columnar epithelium with goblet cells, which ended approximately at the margin of the perforation. In the anteroinferior parts it extended for more than 1 mm. beyond the free margin of the perforation onto the outer surface of the neomembrane. The transition from the columnar epithelium to the squamous epithelium was everywhere abrupt, without intervening transitional epithelium.

Middle Ear: The lumen was filled with purulent exudate and lined with hyperplastic or, in some places, hyperplastic-fibrotic mucosa. The mucosa showed, in addition to a decided round cell infiltration, acute inflammatory changes. The incus was completely missing and the malleus almost completely, with the exception of a small piece of the head, which lay embedded in the connective tissue which filled the attic (fig. 4). The round window niche was extensively filled with bone, and the round window membrane had almost completely dis-

Fig. 2 (case 2).—Horizontal section through the middle ear, neomembrane and basal cochlear turn: *a.c.* indicates the aqueductus cochleae; *b.c.*, bony masses in the lowest part of the cochlear turn; *m.e.*, middle ear; *m.st.*, stapedial muscle; *n*, perforated neomembrane; *n.VII*, facial nerve; *p.v.c.*, posterior vertical canal, partially filled with bone; *r.w.n.*, remnants of the round window niche, and, +, borderline between stratified squamous and pseudostratified columnar epithelium.

appeared. The oval window niche was considerably narrowed through apposition of bone to its walls, and its communication with the middle ear was reduced to a narrow canal (fig. 3). The window itself showed apposition of bone to the entire circumference of the frame; its transveral diameter was 2 mm. and its vertical diameter 1 mm. The window was closed by a membrane consisting of rather dense connective tissue. Attached to the outer surface of this membrane and surrounded by the connective tissue within the window niche was a remnant of the footplate of the stapes. Its osseous part was extensively destroyed, but the cartilage covering its inner surface was almost everywhere preserved. The remaining parts of the stapes were missing, with the exception of a small piece of the basal part of the posterior crus.

Fig. 3 (case 2).—Horizontal section through the oval window: *c.t.* indicates connective tissue and bone in the vestibule; *i.a.m.*, internal auditory meatus; *n.VII*, facial nerve, and *st.*, remnants of the footplate and the posterior crus of the stapes.

Anteriorly the middle ear went over into the eustachian tube. The epitympanic space was filled with loose connective tissue and contained only a small extension of the lumen of the middle ear. The bony walls were thickened, and a transverse septum separated the attic completely from the antrum (fig. 4).

Mastoid and Petrous Pyramid: The mastoid was only partially contained in the sections and seemed to be completely sclerotic; only a few retrofacial cells were visible. They contained only small lumens and were lined with highly hyperplastic mucosa. The antrum was wide and transformed into a closed abscess cavity. Its walls consisted of an inner layer of granulation tissue and an outer layer of connective tissue. The lumen contained necrotic debris. The surrounding

bone was highly sclerotic and contained only small vascular spaces filled with loose connective tissue. The abscess cavity extended backward and medially around the labyrinth. In the region of Trautmann's triangle it was separated from the dura by a bony plate approximately 3 mm. thick. Numerous vessels were seen traversing this bony plate and connecting the vascular system of the

Fig. 4 (case 2).—Horizontal section through the attic, abscess cavity in the mastoid and epidural abscess: *a* indicates attic; *abs.*, epidural abscess; *m*, abscess cavity in the mastoid; *ma.*, remnant of the head of the malleus; *m.t.t.*, tensor tympani muscle; *n. VII*, facial nerve; *n.b.*, newly formed bone; *p.v.c.*, posterior vertical canal, filled with bone; *s*, bony septum between the attic and the abscess cavity in the mastoid; *v.*, vascular connections between the abscess cavity in the mastoid, dura periosteum and epidural abscess, and, *ve.*, vestibule, partially filled with connective tissue.

abscess walls with that of the dura and periosteum. A group of vessels in the approximate level of the upper half of the internal auditory meatus was seen to go medially and anteriorly and terminate in the wall of a large epidural abscess of the posterior fossa. This abscess extended from the petrous ridge in an oblique direction forward and downward over the posterior surface of the petrosum almost to its inferior border. Posteriorly, it reached in its upper portion the anterior border of the sigmoid sinus; in the lower portion it ended just in front of the endolymphatic sac. The distance between its anterior border and the posterior wall of the internal auditory meatus was approximately 8 mm. The abscess contained pus and several bony sequestrums (fig. 5); its walls were formed by a thick layer of granulation tissue. In some places were small bony sequestrums embedded in the granulation tissue itself. The inner surface of the petrosum

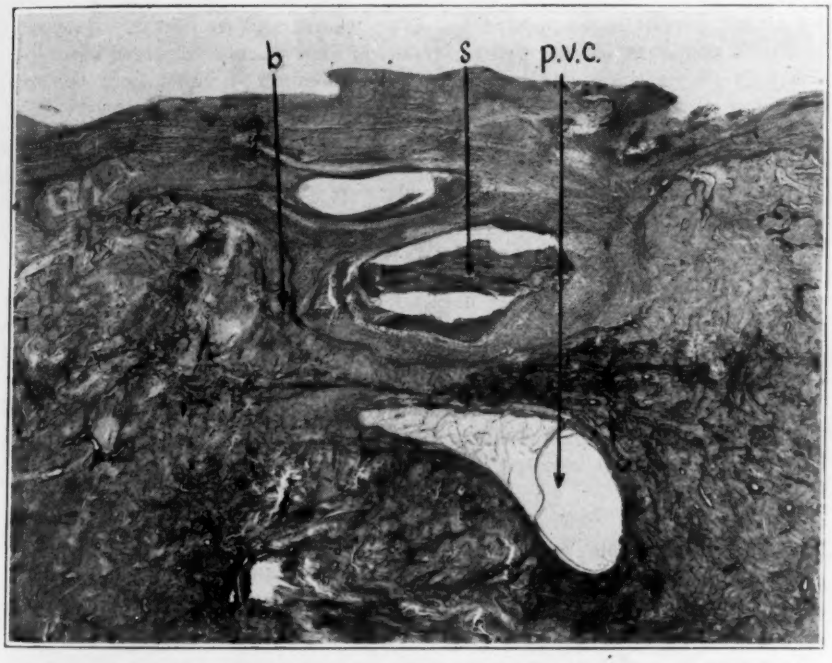

Fig. 5 (case 2).—Horizontal section through the epidural abscess: *b* indicates bone deposited to the wall of the abscess cavity; *p.v.c.*, posterior vertical canal, partially filled with bone, and *s*, bony sequestrum.

showed several smaller and one deep excavation. In the center of the latter a large piece of necrotic bone was seen partially surrounded by pus and partially by granulation tissue. Progressive destruction of bone was seen only in some small peripheral areas; apposition of bone was almost missing. In large areas, however, the structure of the inner surface of the bone indicated that it was deposited on a previously eroded surface. The outer surface of the dura was also covered with a thick layer of granulation tissue. In the central parts of the abscess, where the cerebellum was adherent to the inner surface of the dura, the latter was extensively infiltrated with leukocytes. In several places it was completely destroyed and replaced by granulation tissue, which evidently had

extended to the surface of the cerebellum. In some peripheral pockets, the lumen of the abscess had become obliterated and the granulation tissue had been transformed into fibrous tissue.

The petrosal tip consisted of diploic bone; the marrow spaces contained mainly fat marrow and in small areas only hemopoietic marrow.

Inner Ear and Internal Auditory Meatus: Cochlea. The lumen of the lowest part of the basal turn was completely filled with bone (fig. 2). The latter extended into the scala tympani through the round window into the bony masses in the window niche. It covered the internal opening of the aqueductus cochleae, but the latter itself was free from pathologic changes. The cochlear duct was completely destroyed in this area, and the bone in the scala vestibuli extended for a short distance into the adjacent part of the vestibule. In the other parts of the cochlea the lumen was free from pathologic contents. The organ of Corti was completely missing and the stria vascularis atrophic. The tectorial membrane had almost completely disappeared and when present was considerably shrunken. Reissner's membrane was not well preserved; in some places it appeared distended. The cells of the spiral ganglion were greatly diminished in number; the few remaining cells were atrophic and the fibers of the cochlear nerve degenerated.

Vestibule and semicircular canals. With exception of the areas adjacent to the scala vestibuli (figs. 3 and 4), the vestibule was free from pathologic contents. The walls of the utricle and saccule were torn (artefacts); both maculas were severely atrophic. The endolymphatic duct and sac were well preserved, with the exception of a small area of the duct where it left the bony canal and entered the dura. In this part, the epidural abscess extended close to the duct and the lumen of the latter was obliterated for a short distance. The cristae acusticae of the semicircular canals were severely atrophic; the superior vertical and lateral membranous canals were collapsed. The posterior vertical canal was filled with bone except for small stretches adjacent to the ampulla and to the common crus (figs. 2, 4 and 5). The latter occupied the perilymphatic space and compressed the membranous canal. Only in a relatively small area had the membranous canal completely disappeared, and the entire lumen was filled with bone.

Internal auditory meatus. There was a decided atrophy of the fibers of the cochlear nerve, the branches of the vestibular nerve and the cells of the vestibular ganglion. Otherwise the meatus was free from pathologic changes.

Left Temporal Bone.—There were no pathologic changes. The mastoid was well pneumatized and the labyrinthine capsule surrounded by pneumatic cells. The petrous tip contained diploic bone and the marrow spaces mostly fat marrow.

Summary.—A woman 36 years old suffered from a right-sided chronic otitis media following scarlet fever at the age of 12. For the last four years she had attacks of headaches and dizziness, of increasing intensity, with a transitory weakness of the right arm and adiadokokinesis. She died suddenly. The autopsy showed two encapsulated cerebellar abscesses, one in the cortex of the right hemisphere and one in the central white matter. They had developed from a large epidural abscess at the posterior surface of the petrous pyramid. The latter was the sequel of a chronic otitis media with destruction of the ossicles, destruction of the drum membrane, with formation of a perforated neomembrane, and transformation of the wide antrum into a closed abscess cavity. The inner ear showed evidence of a healed serous labyrinthitis, with ossification of the lowest part of the basal cochlear turn and of the posterior vertical semicircular canal.

CASE 3.—B. Rosa, a woman aged 30 years, was admitted to the Presbyterian Hospital in New York on June 13, 1941. She had had discharge from both ears at frequent intervals since childhood and numerous attacks of sinusitis. One month before admission she had some nasal treatment by a local physician, and since that time she noticed discharge from both ears. A few days later severe pain developed over the left side of her head, and it had persisted since that time. Five days before admission she had an attack of dizziness, without nausea, vomiting or falling.

On admission, a moderate amount of pus was seen in both external auditory meatuses. The right drum showed a perforation in the inferior half; the left drum was completely absent, and the mucosa of the middle ear was red but there was no evidence of erosion of the osseous frame. All the other findings were essentially normal. Cultures taken from both canals were contaminated with Bacillus proteus. The audiogram showed a bilateral conduction deafness. The hearing loss averaged 40 decibels on the right and 60 decibels on the left side.

Three days after admission the patient started having vertigo, with nausea and vomiting and nystagmus, with the quick component to the left. At the same time the discharge from the right ear increased in intensity. The neurologic examination was essentially noncontributory. A lumbar puncture was done, and the fluid pressure was found to have increased to 230 mm., with free rise on jugular compression. There were 4 white blood cells per cubic millimeter, and chemical examination of the spinal fluid showed normal sugar, slightly increased protein and slightly decreased chloride contents. There was a moderate leukocytosis (15,000, with 78 per cent polymorphonuclears) and an erythrocyte sedimentation rate of 50 mm.

The diagnosis of a right-sided mastoiditis with perilabyrinthitis was made and a simple mastoidectomy performed. The cells were found to be lined with swollen mucosa; in a cell group near the tegmen there was evidence of some destruction of bone. Free pus was nowhere seen.

The following day the patient was extremely stuporous. A conjugate deviation of the eyes to the right and a bilateral positive Babinski sign were noticed. The other neurologic findings were again normal. The lumbar puncture was repeated. The pressure was 246 mm., and there were 42 erythrocytes and 428 leukocytes per cubic millimeter, 89 per cent of them polymorphonuclears. Sugar and protein contents were slightly increased and chloride content slightly decreased.

One day later the patient suddenly died.

The autopsy showed adhesions between the left cerebellar hemisphere and the dura of the posterior fossa in a small area behind the internal auditory meatus. There was a localized meningitis in the posterior cranial fossa. The major part of the left cerebellar hemisphere was occupied by a rather large acute abscess. The latter extended for a short distance into the middle cerebellar peduncle and displaced the left dentate nucleus dorsomedially. There was decided collateral edema and a pressure cone. The brain stem showed a slight distortion due to the compression of the left middle cerebellar peduncle but no other changes of note. The pus from the abscess contained a great many gram-positive cocci in short chains.

The histologic examination of the temporal bones was incomplete because only the petrosa and adjacent parts had been removed from the body; however, it nevertheless explained the pathogenesis of the changes in a satisfactory way.

Right Side.—The middle ear cavity contained some mucous exudate which was poor in cells. The cavity was lined with hyperplastic mucosa and covered with pseudostratified ciliated columnar epithelium. There was moderate round cell infiltration of the superficial mucosal layers. The perilabyrinthine cells were poorly developed and lined with the same mucosa as the middle ear cavity and the antrum. The petrous tip consisted of diploic bone with fat and hemopoietic marrow. The mastoid contained an operative cavity. The surrounding cells contained some blood and fibrinous exudate. The labyrinthine capsule and the membranous labyrinth were free from pathologic changes. The fundus of the internal auditory meatus contained a small amount of purulent exudate.

Left Side.—The lumen of the middle ear contained some mucous exudate, with a moderate amount of leukocytes. It was lined with thick hyperplastic mucosa which was infiltrated with round cells and polymorphonuclear leukocytes.

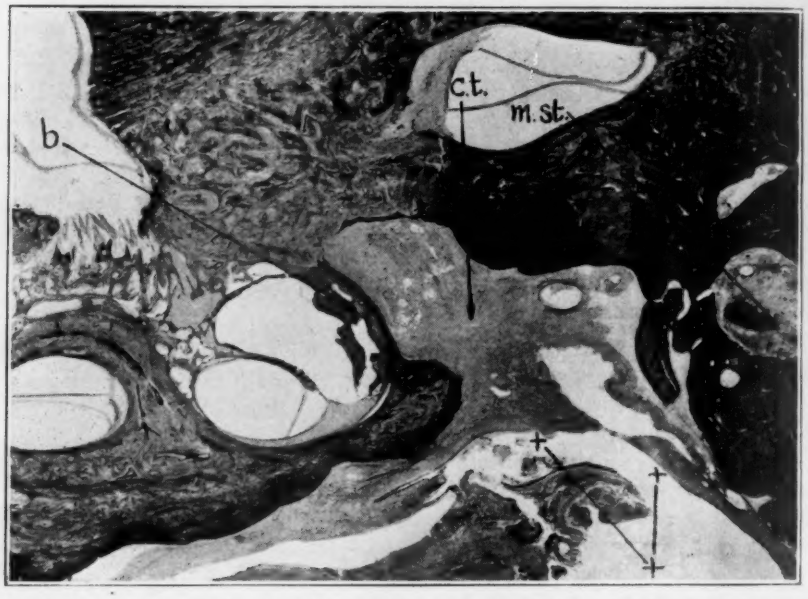

Fig. 6 (case 3).—Round window niche: *b* indicates bony plate filling out the lowest part of the scala tympani; *c.t.*, connective tissue in the window niche; *m.st.*, stapedial muscle, and, +, borderline between squamous and columnar epithelium.

In most parts the mucosa was covered with pseudostratified ciliated columnar epithelium with goblet cells; only parts of the floor were lined with superficially keratinized stratified squamous epithelium which had grown in from the floor of the external auditory meatus (fig. 6). The transition between the two kinds of epithelium was abrupt; in many places short, tonguelike projections of the squamous epithelium extended beneath the columnar epithelium. The mucosa in the areas covered with squamous epithelium was thinner and more fibrous in character than in the areas covered with columnar epithelium. The malleus and incus were not contained in the sections. The stapes was embedded in hyperplastic and cystic mucosa. The round window niche was filled with hyperplastic mucosa which contained many cysts (fig. 6). The antrum was wide and con-

tained some exudate and masses of organized tissue. The petrous apex showed few pericarotid cells which were lined with thick mucosa. Otherwise the tip consisted of diploid bone with hemopoietic and fat marrow.

Mastoid Process: The bone was well pneumatized and, particularly the perilabyrinthine cell groups, well developed (fig. 7). They extended above and behind the labyrinth forward into the vicinity of the posterior and superior wall of

Fig. 7.—Horizontal section through the middle and inner ear and retrolabyrinthine abscess: *abs.*, indicates abscess; *br.*, breakthrough; *c*, perilabyrinthine cells; *d.e.*, ductus endolymphaticus; *n.b.*, new bone; *p.v.c.*, posterior vertical canal, and *v.*, vestibule.

the internal auditory meatus. The cells were lined with thick, fibrillar mucosa. The latter was in some cells edematous and only slightly infiltrated; in others the infiltration was much heavier, with polymorphonuclear leukocytes predominating. The lumen of many cells was empty, and others contained mucoid exudate. This exudate in many places was being organized by ingrowth of young connec-

tive tissue from the walls and formation of masses of organization tissue which was connected with the walls through thin bridges of tissue. The bony walls of many cells showed apposition of osteoid in the form of a thin layer or of a network. In other cells osteoclastic erosion from the surface or from perivascular spaces was noted. The intercellular septums of the retrolabyrinthine cells were extensively destroyed, and a large abscess cavity had been formed through confluence of the cells. This was filled with pus and contained several small bony sequestrums. The lining mucosa was heavily infiltrated with leukocytes and in many areas completely destroyed. In many of the adjacent cells intensive destruction of bone was noted, accompanied in some places with new formation of osteoid. New formation of bone was also seen in the posterior wall of the large abscess cavity. The bone surrounding the anterior part of the cavity showed a definite rarefying osteitis; the lateral outer wall of the cavity was represented by the periosteal capsule of the labyrinth. It showed some osteoclastic erosion from the surface but little rarefying osteitis. The medial inner wall was thin; near the place where it went over into the posterior wall, it was destroyed in an area measuring approximately 2 mm. in diameter. Granulation tissue extended from the abscess cavity to the outer surface of the dura, and an epidural abscess had been formed, which extended forward for about 10 mm. The dura was extremely thickened and heavily infiltrated with polymorphonuclear leukocytes. To its inner surface in this area the left cerebellar hemisphere had been adherent. Small breakthroughs were also noted in the anterosuperior parts of the medial bony wall but without striking infiltration of the covering dura.

Labyrinth: The lowest part of the scala tympani was filled out with a bony plate, approximately 0.6 to 0.8 mm. thick, which overlaid the round window membrane. It consisted of weblike fibril bone in netlike arrangement. Apposition of bone had also occurred at the medial inner surface of the promontory; the adjacent parts of the round window membrane itself were also ossified. The bony masses in the scala tympani surrounded the internal opening of the aqueductus cochleae but did not obstruct it. The aqueductus itself was free from pathologic changes. The endolymphatic duct ran backward along the inferolateral circumference of the abscess cavity and was surrounded by a layer of bone. The duct as well as the sac was free from pathologic changes.

Internal Auditory Meatus: The arachnoidal cisterna in the fundus contained some purulent exudate. There was a moderate leukocytic infiltration of the vascular and nerve channels leading into the interior of the labyrinth.

Summary.—A woman 30 years old had intermittent discharge from both ears since childhood. After nasal treatment the discharge reappeared; four weeks later the patient started having dizziness and nystagmus to the left side, with increase of the discharge from the right ear. No other neurologic symptoms were present. There was a central perforation in the right drum and a total destruction of the left, without evidence of bone erosion or cholesteatoma. A right-sided mastoidectomy was done, but the operative findings did not explain the symptoms. The following day the patient became stuporous, a conjugate deviation of the eyes to the right developed and a bilateral positive Babinski sign was noticed. One day later the patient died.

The autopsy showed a rather acute cerebellar abscess which occupied the major part of the left hemisphere.

There were no particular changes in the right temporal bone. On the left side a mastoiditis with predominantly productive inflammatory changes was found, with formation of a retrolabyrinthine and of an epidural abscess of the posterior fossa, from which the infection of the cerebellum had taken place.

COMMENT

In case 1 an abscess of the temporal lobe was found seventeen years after an acute otitis media of one week's duration, which clinically had cleared up completely. From that time on, symptoms attributable to the ear were completely missing until the patient's death. The first symptoms which, in retrospect, could have been caused by the developing abscess of the brain appeared about nine months before the patient's death, and, thus, concluding from the clinical evidence one could estimate the age of the abscess as approximately nine months. The histologic structure of the wall of the abscess does not permit definite conclusions concerning the age of the abscess; the fact, however, that it showed a fairly well developed capsule consisting of proliferated connective tissue without glia is well compatible with the assumed age of nine months. The formation of a capsule does not necessarily mean that an abscess entered the stage of final healing. A well established and thick capsule may be broken through at any time by an acute exacerbation of the suppuration and, furthermore, the inflammation may, without fistulous perforation, migrate through the capsule and produce a new abscess in the neighborhood of the old one (Brunner).[1] This had happened in the case just discussed. The symptoms noticed four months after the supposed onset of the abscess, consisting of severe headaches, transitory weakness of the left arm and leg and temporary rise in temperature to 105 F. (May 1938) were probably due to the development of the smaller abscesses in the vicinity of the large one. Their lesser age is suggested by the smaller amount of proliferation of the connective tissue in their walls.

The complete absence of aural symptoms and the location of the abscess in the right temporal lobe were the causes for the diagnostic difficulties encountered in this case.

Cases of otogenic abscesses of the brain in which the underlying infection of the middle ear was clinically completely healed at the time when the abscess of the brain had been discovered have occasionally been reported in the literature (Henius,[2] Swierz,[3] Stark[4] and others). The interval between infection of the middle ear and brain abscess was longest in the cases reported by Swierz (ten years) and Stark (two years).

1. Brunner, H.: Otogene endokranielle Erkrankungen, in Bumke, O., and Foerster, O.: Handbuch der Neurologie, Berlin, Julius Springer, 1936, vol. 10.

2. Henius, P.: Fälle von otogenem Hirn-abscess nach geheilter Mittelohrentzündung, Acta oto-laryng. **5**:295, 1923.

3. Swierz, cited by Goldflam, S.: Beiträge zur Symptomatologie des Schläfenlappenabszesses, Deutsche Ztschr. f. Nervenh. **90**:38, 1926.

4. Stark, W. B.: Mastoiditis and Parasinous, Epidural and Cerebellar Abscess Without Apparent Disease of the Middle Ear, Proc. Staff Meet., Mayo Clin. **5**:3, 1930.

The opinions of the authors as to whether the abscesses of the brain were formed at the time of the clinically manifest suppuration or later vary. Dixon,[5] for example, stated that a patient may harbor a brain abscess for as long as sixty-four years. Swierz also stated the belief that the abscess in his case had remained latent for many years. Henius expressed the opinion that in the majority of cases the abscess is formed in the acute stage of the suppuration of the middle ear but that in others, particularly those complicated with epidural abscesses, the abscess of the brain may also be formed at a later date. It is generally recognized that in traumatic abscesses of the brain the period of latency may be many years, for example, thirty-seven years in a case reported by Nauwerck.[6] In otogenic abscesses, however, the longest proved latency, according to Körner,[7] was only one and one-fourth years. In our opinion, generalizations should be avoided and each case considered individually by the weighing carefully of the clinical as well as the anatomic findings before any conclusions are drawn.

In case 1 in this paper, the infection had cleared up in the middle ear and mastoid but had progressed into the retrolabyrinthine cells and from there forward and upward through the roof of the internal auditory meatus into the petrosal tip. A slowly growing epidural abscess of the posterior fossa had been formed, which had gradually extended underneath the superior petrosal sinus into the middle fossa and from here through the dura into the temporal lobe.

The significance of perilabyrinthine suppurations as intermediate stages in the pathogenesis of endocranial complications has been well formulated by Wittmaack.[8]

> They lead to circumscribed areas of inflammation at the upper or posterior surface of the petrous pyramid and frequently also involve the adjacent areas of the semicircular canals and the vestibule. Medially, as a rule, they encroach the dura and produce here at first more or less extensive subdural foci of inflammation. Most frequently they are followed by purulent meningitis, brain abscess or sinus phlebitis. The development of the perilabyrinthine suppurations is in striking contrast to the insignificance of the underlying otitis. Sometimes they are even found after slight exacerbations of mucosal suppurations which are regarded as harmless. The development of these foci can only be explained by the assumption that the infection had proceeded along preformed vascular channels into isolated and cystic pneumatic cells or in areas of cancellous bone.

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5. Dixon, O.: Brain Abscess as the Otologist's Problem, J. A. M. A. **96**: 481 (Feb. 14) 1931.

6. Nauwerck, C.: Zur Kenntnis des chronischen traumatischen Hirnabszesse. München. med. Wchnschr. **64**:109, 1917.

7. Körner, O.: Die otitischen Erkrankungen des Hirns, der Hirnhäute und der Blutleiter, ed. 5, edited by O. Körner and K. Grünberg, Munich, J. F. Bergmann, 1925.

8. Wittmaack, K., in Henke, F., and Lubarsch, O.: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1926, vol. 12.

The endocranial complications in these cases are characterized by their sudden and unexpected onset. The presence of the preformed vascular channels is, according to Wittmaack, caused by a disturbance of the pneumatization. In early childhood, circulatory connections between the dura and periosteum and the neighboring portions of the temporal bones are extensive. Normally, they disappear together with the retrogression of the subepithelial layers of the mucosa of the middle ear. In cases with persistence of the high subepithelial mucosa, ("hyperplastic constitution of the mucosa") and impeded pneumatization, the vascular connections may be preserved. Two groups of such vessels are located at the posterior surface of the petrosa, in front of the sigmoid sinus, one immediately below the petrosal ridge and one near the knee of the sinus.

Evidently in case 1 the infection had reached the dura largely by way of the first of the two groups of vessels. It cannot further be definitely decided, however, whether the epidural abscess had been preceded by an empyema of cystic pneumatic cells or by a circumscribed osteomyelitic focus. Spread from the posterior to the middle fossa, with partial necrosis and sequestration of the petrosal ridge, is evidently a well established route of infection in abscesses of the temporal lobe. Similar cases have been described by Druss and Friesner,[9] Grabscheid [10] and others.

The pus from the abscesses of the brain and most probably also from the epidural abscess contained hemolytic streptococci. They are most likely the descendants of the streptococci which caused the original infection of the middle ear; living in a closed cavity, they had lost most of their virulence, and the infection had stayed latent for many years. For some reason, perhaps because of a lowering of the general resistance of the body in the course of an intercurrent acute disease, they had regained their virulence and invaded the brain. The fact that streptococci may remain latent in closed wounds for many years has been repeatedly observed by general surgeons, particularly in traumatic abscesses. The mode of origin just described seems much more likely than the assumption that the original bacteria had died completely, the abscess had remained sterile for an indefinite period and afterward, in the course of an acute infection with bacteremia, virulent streptococci had invaded the brain, having been deposited in the epidural abscess,

In case 2 a cerebellar abscess on the right side was found following chronic otitis media of twenty-four years' duration after scarlet fever.

9. Druss, J. G., and Friesner, I.: Pathways of Infection in Abscess of the Brain, Arch. Otolaryng. **13**:532 (April) 1931.

10. Grabscheid, E.: Otogener Schläfenlappenabszess bei chronischer Otitis media und chronischer zirkumskripter Labyrinthitis, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **130**:175, 1932.

The first symptoms which, in retrospect, could be attributed to the developing abscess (attacks of headache, vertigo, nausea and vomiting) were observed four years before the patient's death. The manifest stage itself, however, lasted altogether only four weeks.

The autopsy showed two cerebellar abscesses, one superficially and one deeply located. The well developed capsule in both of them, together with the glial proliferation in the adjacent areas, makes it probable that both were relatively old. The superficial abscess, with its thicker capsule and the more striking glial proliferation, was evidently older than the deep one; it had most probably been formed when the first cerebellar symptoms were noticed and had remained more or less latent for about four years. The second abscess could possibly have been formed in January 1937, fifteen months before the patient's death, at the time when she had such severe attacks of dizziness that she stayed in bed for a week. At that time a transient weakness of the right arm was noticed, together with an ataxia which lasted for the rest of her life.

Capsule formation is somewhat less common in cerebellar abscesses than in abscesses of the temporal lobe because life expectancy of a person with a cerebellar abscess not operated on is much shorter than that of one with an abscess of the temporal lobe. The long duration of the two abscesses in case 2 is exceptional, and they are by far the oldest abscesses thus far reported in the literature. The simultaneous presence of two cerebellar abscesses is also uncommon; it occurs, according to Körner, in only about 12 per cent of the cases.

The scarlet fever infection in childhood had caused a necrotizing otitis media, with total destruction of the drum and exfoliation of the ossicles (entire incus, malleus with exception of a part of the head, stapes with exception of the posterior half of the footplate and a small part of the posterior crus). It had also led to a diffuse serous labyrinthitis—a relatively frequent occurrence in otitis caused by scarlet fever—which had eventually healed, with a severe atrophy or destruction of all the sensory elements and a partial ossification of the lumens of the cavities. These findings explain the complete loss of the cochlear and vestibular function. The majority of otogenic cerebellar abscesses follow labyrinthine suppurations. If, as in the present case, the abscess is accompanied with a dead labyrinth, the diagnosis of a labyrinthogenic abscess is rather obvious. The findings in case 2, however, show that in spite of a dead labyrinth the abscess is not always of labyrinthine origin.

The necrotizing otitis had been followed by a chronic suppuration from the middle ear. In the course of the reparative changes after the extensive necroses, the round window niche had been completely filled with bone and the oval window niche considerably narrowed. The

middle ear and antrum had become completely separated from each other through the formation of a bony septum; after that exacerbations of the suppuration of the middle ear evidently had no influence on the antrum. The mucosa of the middle ear had been regenerated from parts which were not necrotic, and columnar epithelium had grown over the denuded areas either from islands which were left intact or from the tube. The drum membrane had been replaced by a perforated neomembrane. The extension of the columnar epithelium over the free margins of the anteroinferior circumference of the perforation onto the outer surface of the neomembrane is unusual because usually the stratified squamous epithelium shows the greater growth tendency and extends to the free margin or even for a short distance over it onto the inner surface. This is particularly so in perforations which are still extending.

Extensive necroses of the mucosa of the middle ear occur, according to Wittmaack, only in cases with a hyperplastic type of mucosa, which in turn is accompanied with impeded pneumatization of the mastoid and in many instances a wide antrum. If the mucosa had already been hyperplastic before the infection had taken place—and there is strong evidence that this actually was the case—then this observation would support Wittmaack's assumption. The presence of the hyperplastic mucosa of the middle ear on the right side would represent a predisposing factor and would explain why this side and not the left one with the normal, thin mucosa of the middle ear had been affected.

The antrum had been transformed into a large, completely closed abscess cavity, lined with a pyogenic membrane and surrounded by sclerotic bone. From the posteromedial circumference of the cavity, from the region of Trautmann's triangle, the infection had spread along a group of persistent vessels to the dura and led to the formation of an epidural abscess of the posterior fossa, from which the dura had been invaded. The structure of the walls of the abscess and the presence of the sequestrums indicate its long duration, but there is no way of determining its exact age. In view of the almost complete lack of pneumatic cells in other parts of the mastoid, it is highly improbable that the abscess had been preceded by an empyema in cystic pneumatic cells. Both cerebellar abscesses in this case contained hemolytic streptococci. For the same reasons as in the preceding case of cerebral abscess, one can assume with a fair degree of probability that they were the descendants of the streptococci which had caused the original infection of the middle ear twenty-four years before the patient's death.

In case 3 cerebellar abscess on the left side was found about four weeks after the onset of an acute exacerbation of a bilateral chronic otitis media.

The otoscopic picture (destruction only of the pars tensa of the drum and no evidence of bone erosion or cholesteatoma) in this case was of a kind which is generally regarded as indicative of a harmless suppuration confined to the mucosa. The cerebellar symptoms were not definite in the beginning but gradually increased in numbers and intensity. In view of the impaired but not completely deficient hearing, the diagnosis of a nonlabyrinthogenic cerebellar abscess would have been justified in spite of the misleading otoscopic picture.

The autopsy showed a large, rather acute, cerebellar abscess in the left hemisphere. According to its appearance, it could well have been only four weeks old.

The histologic examination of the temporal bone showed the middle ear lined with hyperplastic, acutely inflamed mucosa. There was a partial epidermization of the lower parts of the cavity with ingrowth of the stratified squamous epithelium from the external canal. This is sometimes observed in chronic otitis media and should by no means be mistaken for cholesteatoma formation. The mastoid was well pneumatized, which is not common in chronic otitis, and its cells were lined with rather thick mucosa. In many of them, scattered throughout the mastoid, there was evidence of a predominantly productive inflammation, with scanty mucoid exudate, while the intervening cells were more or less free from infection. The retrolabyrinthine cells were transformed into a large abscess cavity. The picture is highly suggestive of infection with pneumococcus type III (Altmann and Waltner [11]), although this cannot be proved because of the lack of bacteriologic evidence. The internal cortical layer over the posterior part of the abscess had been eroded and an epidural abscess formed, from which cerebellum had been invaded. Persistent vascular connections evidently did not play a role in the pathogenesis of the epidural abscess in this case.

It is unusual for endocranial complications, particularly abscesses of the brain, to develop in conditions which because of the otoscopic picture are ordinarily regarded as harmless, but such observations have been reported by several authors, e. g., an abscess of the temporal lobe lately by Richter.[12] The extensive pneumatization in case 3 was unquestionably a predisposing factor for the development of the complication. A previous acute exacerbation or reinfection had led to a serous labyrinthitis, which had healed with organization and ossifica-

11. Altmann, F., and Waltner, J. G.: Labyrinthitis Due to Pneumococcus Type III, Arch. Otolaryng. **40**:75 (Aug.) 1944.

12. Richter, H.: Grosser Hirnabszess mit Ventrikelruptur bei anscheinend harmloser chronischer Mittelohreiterung, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **151**:17, 1942.

tion of exudate overlying the round window but without any serious damage of the sensory elements of the inner ear. It seems remarkable and of great theoretic interest that a complete elimination of the function of the round window membrane was accompanied with a conduction deafness, with an average loss for air conduction of about 60 decibels. This was only 20 decibels more than on the other side, where the round window membrane had been intact.

Neither of the cerebellar abscesses reported in this paper were labyrinthogenic, although extension through the labyrinth is the most frequent pathway in chronic infections of the middle ear with cholesteatoma. It is less common in cases without cholesteatoma (case 2) and in acute and subacute infections. To the latter group case 3 must be added in spite of its history and otoscopic findings. In cases of non-labyrinthogenic abscesses, the infection is said to go either through the sigmoid sinus or through Trautmann's triangle. In the latter case the invasion of the cerebellum is as a rule preceded by the formation of a deep epidural abscess of the posterior fossa. This was so in the 2 cases reported in this paper.

SUMMARY AND CONCLUSIONS

Three cases of otogenic abscesses of the brain which presented unusual features are reported. In case 1 an abscess of the temporal lobe had been discovered seventeen years after an acute infection of the middle ear of one week's duration. In case 2 two cerebellar abscesses were found in a patient with chronic otitis media of twenty-four years' duration; in case 3 a cerebellar abscess had followed an acute exacerbation of a clinically and otoscopically benign-looking chronic otitis.

In all 3 cases deep epidural abscesses had preceded the invasion of the brain. In the first 2 cases the infection had reached the outer surface of the dura along persisting vascular connections between the dura and the mucosal lining of infected cells and in case 3 by direct extension within the pneumatic system, with formation of an abscess in the retrolabyrinthine cells and erosion of the inner cortical layer of the petrosal portion of the temporal bone.

The interval between the formation of the epidural abscess and the abscess of the brain had evidently been many years in the first 2 cases but only a few days in the last one.

The age of the abscess of the temporal lobe was estimated as nine months, of the two cerebellar abscesses in case 2 as four and fifteen years respectively and of the cerebellar abscess in case 3 as four weeks.

During the long years of latency the deep epidural abscesses did not give rise to any clinical signs and symptoms but contained, nevertheless, bacteria, which eventually led to fatal endocranial complications.

The presence of these abscesses remains in many instances completely unsuspected; the otoscopic picture and the hearing are entirely normal, or the existing chronic suppuration of the middle ear presents a harmless otoscopic and clinical picture. Because of their deep location, they are not seen in roentgenograms.

Otogenic deep epidural abscesses should always be suspected when signs and symptoms of a purulent endocranial complication are noticed and there is evidence of past or present disease of the middle ear, no matter how harmless the clinical or otoscopic picture may be.

Exploration of the mastoid is definitely indicated in these cases. It is a relatively harmless procedure, which will facilitate successful treatment of the complication.

APPRAISAL OF FENESTRATION OPERATION

Report of One Hundred Cases

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IT IS NOW eight years since Lempert first reported a successful one stage fenestration operation for relieving the deafness of otosclerosis. Enough time has elapsed to prove the efficacy and permanency of this procedure. Even the most skeptical otologists must admit that this operation has proved successful in restoring practical hearing for speech in some cases. Undoubtedly, it is the greatest otologic contribution of the present generation. More and more reports are being submitted by men who have undertaken this intricate and difficult operation, with varying degrees of success. This is a new form of reconstructive plastic surgical treatment, and, while still far from reaching a stage of perfection, the results to date, as reported by different operators, seem to show a definite trend toward a higher percentage of successes. However, what is needed is not simply reports of successes and failures but an attempt to analyze the reasons for them, in the hope of further refinements in technic and management. We also need definite criteria for determining which patients are suitable for operation. Unfortunately, this subject has been so publicized and exploited in the lay press that the hard of hearing public is demanding the operation. There is a resultant tendency to operate on many patients who have little chance of attaining practical hearing. One of the biggest problems is not whether one should advise the operation but whether one should refuse to operate. If practical hearing for normal speech can be achieved by means of the fenestration operation, I believe it to be far superior to the distorted hearing obtained with a hearing aid. If, however, the hearing improvement following operation is insufficient for the understanding of normal speech, regardless of the amount of improvement, I consider the operation a failure, because some form of hearing aid is still needed. It is a poor alibi to suggest that persons with subpractical hearing are better able to utilize a hearing aid. It is only natural that the fenestration operation is receiving much adverse criticism when postoperative results in patients with hearing below the practical level are reported as successes. Pure tone audiometric curves

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do not indicate accurately the level of practical hearing. A few people have practical hearing at a threshold level of 30 to 35 decibels though in most instances the practical level is nearer 25 decibels. The patient himself is the final answer. If he understands normal conversation, he is extremely happy; otherwise he complains.

I am reporting for the first time my complete series of patients operated on up to December 1945. I am doing this primarily as my authority for offering certain suggestions concerning the selection of patients as well as several minor changes in technic and management which I believe have contributed to an increasing number of successful results in my series. Although I have been engaged in this work for six years, I have performed a relatively small number of fenestration operations as compared with some of my confreres.

DIAGNOSIS

There should be little difficulty in properly diagnosing otosclerosis with fixation of the stapes. In one hundred consecutive operations I have routinely tested the stapes with a probe. I found it to be definitely fixed in ninety-four. In 4 cases, the crura of the stapes were found to be fractured after removal of the incus. In 1 case there was some hemorrhage around the area of the footplate of the stapes, so the patient was not tested. The patient in whom the stapes was found to be definitely movable showed a fusion of the incus with the head of the malleus. The only clinical test that I know for fixation of stapes is the Gellé test. I believe that this test is helpful, but it is only suggestive. One finding that I have noted and which I have not seen reported elsewhere is the frequent occurrence of a patchy atrophy of the ear drum, which sometimes gives the appearance of several small, healed perforations. With bright illumination, I have observed some discoloration of the inner wall of the middle ear in at least 30 per cent of my cases. A positive family history of deafness has been obtained in not more than half.

SELECTION OF CASES

I have been conservative in the selection of patients on whom I have operated and have tried to limit my operation strictly to those in whom I should expect practical speech hearing if the operation is successful. I can claim only 4 patients of the 100 as being poorly selected. Therefore, I offer no excuse for any patient in this series who did not reach a practical hearing level following operation.

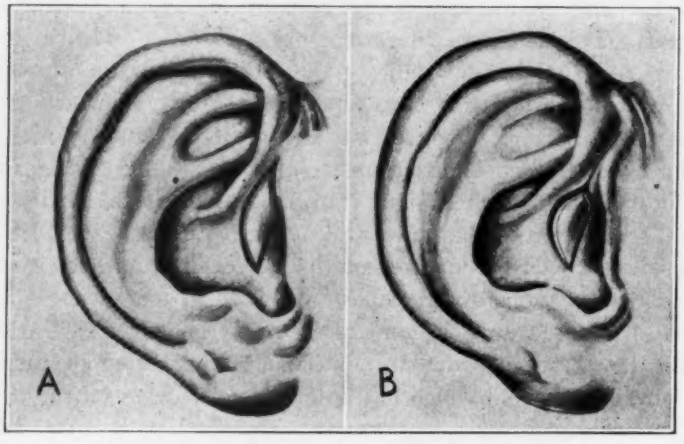
I believe that the operation is of greatest value in young adults and becomes of less and less value after the fourth decade of life. Young persons heal better and show prompter recovery from operation. The patients in the early forties on whom I have operated have a

tendency to heal more slowly, and the hearing usually does not recover to as high a level as in the younger ones. In this series of cases, I have operated on no patient over 45 years of age, although occasionally one sees persons in the fifties who are suitable patients so far as hearing curves are concerned. Hearing loss by air conduction must be below the practical level for normal speech. The bone conduction loss should be slight, especially around the level of 2,000 cycles. I have operated on only 4 patients with hearing loss by bone conduction of over 30 decibels in the speech range, and they failed to show postoperative improvement to a practical level. I realize that there are no standard bone conduction tests and that bone conduction audiograms are at best inaccurate. Personally, I always supplement my bone conduction audiograms with tuning fork tests. When there is a disproportionate hearing loss between the two ears, bone conduction tests on the poorer hearing ear may be misleading and actually reflect the hearing of the better ear. This occurred in case 94 in my series. Hearing curves alone are not sufficient to indicate the suitability of any patient for operation. I believe that a clean upper respiratory tract and freedom from nasal allergy are important. I hesitate to accept any patient for operation who is psychologically unstable or maladjusted. The rapidity of the hearing loss is often significant. A rapid loss of hearing, with diffuse discoloration of the inner wall of the middle ear, would indicate an extensive otosclerotic involvement of the cochlea and make the value of the operation more questionable. Case 20 in my series is a good example of this. It must be remembered that improvement in hearing following fenestration is due to a mechanical unlocking or mobilizing of the labyrinthine fluid which has no effect whatsoever on the progress of the otosclerotic process.

OPERATIVE PROCEDURE

In the original operation, the fenestra was made far back in the horizontal semicircular canal and the incus was not removed. The percentage of successful results from this procedure was found to be low, partly due to the small caliber of the canal into which the fenestra was made. If an attempt was made to enlarge the fenestra too much, obliteration of the horizontal canal frequently resulted. In 1941 Lempert reported a modification of his original procedure, in which the fenestra was made further anteriorly so that it opened into the ampullated end of the horizontal semicircular canal and exposed the vestibule. This modification was a distinct improvement, since the new fenestra was much closer to the oval window and actually opened into the vestibule. The fenestra here could be made wider, and it opened into a larger cavity, so there was less risk of closure. Moreover, in the anterior position, the part of the lining of the external meatus which

covered the fenestra would be thinner, and therefore a higher hearing level could be expected. The fenestra is covered by the periosteal lining of a flap taken from the roof of the external auditory meatus. Reports that Shrapnell's membrane can cover the fenestra I believe to be incorrect, as an anatomic impossibility. In 1944 a further modification of the fenestration operation was reported by Lempert, in which a cartilaginous stopple was used to fill the window. The purpose of the stopple is to prevent bony closure and seal off the contents of the vestibule so that there may be less likelihood of labyrinthitis and inflammatory reaction within it. I have not attempted to use the stopple myself, as I am not yet convinced of its value. Even if it accomplishes the two objectives for which it is intended, it should act as a partial insulation against sound penetrating through it and therefore should



A, standard incisions; *B*, modified incisions.

lower the hearing level which is attained. Admittedly, the two main causes of failure with the fenestration operation are bony closure of the fenestra and formation of fibrous tissue within it. Factors which contribute to bony closure are foreign material, such as bone dust, within the fenestra, fine microscopic spicules of bone adherent to the flap covering it, incomplete removal of endosteum and inflammatory reaction. The more the tissues are traumatized, the greater is the inflammatory reaction. A mangled and swollen flap covering the fenestra can be expected to give a definite inflammatory reaction. The degree and duration of the serous labyrinthitis which always follows the operation are directly dependent on the amount of inflammatory reaction. Throughout the technical performance of the operation, infinite pains should be taken to reduce trauma of the soft tissues to a minimum. This applies not only to the operation itself but also to the after-care.

Also I consider hemorrhage to be a definite factor in causing failures with this operation. There may be slight bleeding from the margins of the flap and adjacent bone, or there may be bleeding from capillary vessels within the labyrinth itself. I believe that the latter is one cause of fibrosis and the unexplained failure of hearing to improve in some cases in which the technical procedure apparently has been faultless.

MODIFICATIONS OF STANDARD TECHNIC

There are probably many minor variations from the standard Lempert technic for performing this operation. What is helpful to one may be a hindrance to another, as, for example, some may prefer an endaural approach and others a postauricular approach. I have no criticism of either. Irrigating the operative field with isotonic solution of sodium chloride to cleanse it of bone dust, blood and debris, whether intermittently, as done by Lempert, or continuously, as advocated by Shambaugh, is a definite refinement. I believe that any variations from the established procedure which would seem to contribute to a higher percentage of successful results or to a higher degree of hearing recovery should be reported. During the past two years I have made several minor changes from the accepted technic in operating on my patients. The fundamental aim of these modifications has been to reduce inflammatory reaction in the wound, thereby decreasing the secondary labyrinthitis, shortening the convalescence and, finally, obtaining a higher postoperative hearing level.

1. I no longer remove a wedge of tissue between the tragus and the helix but simply employ a single line incision in this area. It begins at the outer superior margin of the external meatus and is carried upward anterior to the border of the helix far enough to provide an adequate operating field. This incision is made down to but not into the temporal muscle. At the end of the operation it is closed with sutures or clips. This eliminates most of the postoperative pain and discomfort, which means less inflammatory reaction. I rarely have a patient who complains of pain at any time following this operation.

2. I perform a partial mastoidectomy, removing only sufficient cellular bone around the mastoid antrum to provide adequate working space. I do not exenterate the mastoid below the level of the floor of the external meatus or posteriorly beyond the sinus plate. I do this partial mastoidectomy for two reasons. First, a smaller cavity causes less reaction, heals better and is easier to take care of. The criticism that partial removal of the mastoid cells may result in infection of the remainder and might give rise to mastoiditis and complications I believe to be academic. I have had no such experience. The second purpose of partial mastoidectomy is to alter the preoperative size and

shape of the air chamber in the external meatus as little as possible. I believe that this results in better hearing. A large mastoid cavity would change the acoustic properties of the ear, cause distortion of sound reception and have a tendency to cause echoing.

3. I have discarded the use of melted paraffin to fill the cavity at the end of the operation. In 2 cases in my series on removal of the paraffin there was found to have been some bleeding which apparently had worked underneath the flap. This resulted in fibrosis and failure. This bleeding evidently had occurred from the flap margin or from bone in its vicinity. Moreover, if the cavity is filled with paraffin, the wound must be kept open in order to remove the paraffin, which causes considerable pain. I have reverted to the use of paraffin gauze, using several small pledgets which are packed snugly but not tightly over the flap to hold it in position. No attempt is made to stretch the flap or put tension on it in order to get the thinnest portion over the fenestra. This packing is entirely removed on the fifth day, the dressing discarded and sterile cotton used to close the external meatus. I have found the flap firmly adherent by the fifth day and believe that the sooner the packing can be removed and the cavity left alone, the less will be the inflammatory reaction in the tissues. The cavity is undisturbed for the next two or three weeks except for the removal of excessive secretions. At no time do I intentionally rub the flap with cotton applicators or elicit a fistula reaction.

This is one operation in which I never try to hurry. I know of no operative procedure which requires more delicate and meticulous work. The cutting and handling of the meatal flap which covers the fenestra require particular care and deserve special mention. It is surprising how easily the flap becomes swollen, boggy and discolored if not treated gently. I always spend considerable time examining the periosteal surface of the flap in search for the finest possible spicules of bone, often resembling tiny fish scales. I do this after cutting and freeing the flap, as it is impossible to identify and remove many of these spicules while the flap is taut and fixed. I think that the presence of these spicules in the area of the fenestra is a frequent cause of bony closure. These minor technical points may seem rather elementary, but I believe that the observance of them is of utmost importance in obtaining better results.

RESULTS

My experiences in operating on my first 100 patients, which include those operated on from 1940 to 1945, are briefly as follows:

Table 1 gives detailed results in hearing for pure tones and speech of the 80 patients with successful results from operation in this series.

Tables 3, 4 and 5 give the details of the failures, with accompanying comments. I believe that nearly every failure in my series was due to faulty selection of patients for operation, to technical faults connected with the operation and postoperative care or to postoperative complications.

The summary of the hearing results in these 80 cases is given in table 2.

Cases 1 to 10.—Operation was done by the original Lempert technic, with the fenestra in the horizontal semicircular canal, June 1940 to September 1941. Four patients have practical hearing, 2 partial improvement but impractical and 4 are unimproved.

In the remaining 90 cases the fenestra was made in the ampullated end of the horizontal canal, Lempert's nov-ovalis operation.

Cases 11 to 50.—The patients were operated on between October 1941 and December 1943. Thirty patients have practical hearing, 3 unsatisfactory improvement, 5 are unimproved and 2 worse.

Cases 51 to 100.—The patients were operated on between December 1943 and December 1945. Forty-six have practical hearing, 1 unsatisfactory, 1 is unimproved and 2 worse.

The fenestra closed in 2 of the first 10 cases; it closed in 7 of the next 40 cases, and it closed in but 1 case in the last 50. There have been six revisions, three of which were successful and resulted in practical hearing.

COMPLICATIONS AND SEQUELAE

There have been no serious complications in any of this series—no facial weakness, operative infections or dead labyrinths. One patient had serous labyrinthitis lasting four weeks following operation, which resolved, with the patient attaining practical hearing.

Postoperative infections are frequent. In 1 patient infection developed ten days postoperatively; in 2 patients it developed two weeks postoperatively, in 1 of whom the condition was an acute fungous infection. From six to eight weeks postoperatively, about 30 per cent of my patients have shown simple superficial infections in the cavity, which have not affected the hearing results. Most of these infections responded readily to conservative treatment such as is used for a radical mastoidectomy. Occasionally, the healing is greatly delayed and may take several months.

In 2 patients acute secretory conditions of the middle ears developed some months following the operation. In 1 of these patients the hearing showed a permanent loss of 10 to 15 decibels. In the other case, the hearing returned to the postoperative level.

There have been 4 cases of acute suppurative otitis media months or years following the operation. Two of the patients had associated serous labyrinthitis. They all resolved, with no permanent loss of hearing.

TABLE 1.—*Hearing Survey in Cases 1 to 100 (Successful Results in 80)*

Number	Name	Age	Date of Operation	Pure Tones,*			Last Test	Speech †		
				Before	After	Gain		Before	After	Gain
5	F. M.	33	4/41	47	17	+30	6/45	42	11	+31
6	M. H.	27	5/41	41	19	+22	7/45	29	12	+17
9	S. S.	23	9/41	54	22	+32	11/45	48	22	+26
10	S. F.	37	9/41	54	21	+33	5/45	41	23	+18
12	E. S.	24	11/41	55	20	+35	10/45	41	16	+25
13	W. R.	34	11/41	55	27	+28	4/46	39	19	+20
14	J. G.	18	11/41	58	15	+43	1/46	46	12	+34
15	H. B.	29	12/41	45	16	+29	10/42	34	16	+18
17	J. W.	38	1/42	52	17	+35	1/46	39	16	+23
18	R. R.	27	1/42	39	23	+16	1/46	32	16	+16
19	A. H.	33	2/42	44	23	+21	1/46	35	10	+25
21	R. B.	32	2/42	50	18	+32	1/45	42	7	+35
23	M. G.	35	4/42	51	24	+27	10/44	35	22	+13
24	C. M.	35	5/42	52	17	+35	12/44	43	15	+28
25	E. S.	20	5/42	56	18	+38	10/45	34	15	+19
26	J. C.	34	6/42	54	19	+35	9/44	43	22	+21
27	R. P.	29	8/42	41	26	+15	2/46	31	20	+11
28	O. E.	41	8/42	40	13	+27	10/45	30	14	+16
29	W. D.	37	9/42	38	12	+26	4/45	30	10	+20
30	L. B.	29	9/42	40	20	+20	3/46	30	9	+21
31	C. F.	16	10/42	42	15	+27	11/45	36	15	+21
32	A. J.	34	10/42	43	23	+20	3/46	38	20	+18
34	E. G.	32	11/42	50	13	+37	12/45	40	14	+26
36	R. C.	29	12/42	47	21	+26	4/46	39	13	+26
37	E. H.	33	1/43	48	20	+28	1/44	41	9	+32
38	D. B.	30	2/43	47	17	+30	1/46	37	7	+30
40	W. S.	19	4/43	47	20	+27	1/46	44	13	+31
41	H. A.	20	5/43	48	27	+21	4/46	38	24	+14
42	J. K.	18	6/43	55	20	+35	1/46	39	13	+26
43	J. B.	20	6/43	50	17	+33	5/46	34	20	+14
46	H. B.	36	10/43	45	18	+27	11/45	30	11	+19
48	H. E.	34	11/43	48	26	+22	2/45	34	20	+14
49	F. C.	39	12/43	49	13	+36	3/46	45	12	+33
50	M. H.	32	12/43	55	18	+37	12/45	44	17	+27
51	M. Mc.	28	1/44	42	20	+22	3/46	30	19	+11
52	J. M.	34	1/44	58	26	+32	4/45	40	18	+22
54	S. H.	34	2/44	52	13	+39	12/45	40	14	+26
55	E. H.	26	2/44	55	13	+42	3/46	42	6	+36
56	C. M.	29	4/44	45	22	+23	3/46	32	12	+20
57	S. S.	26	4/44	48	13	+35	11/45	42	17	+25
58	S. B.	42	5/44	60	25	+35	3/46	45	23	+22
59	J. N.	26	5/44	57	17	+40	3/46	50	16	+34
61	E. C.	37	6/44	46	12	+34	4/46	28	13	+15
62	C. M.	38	6/44	47	25	+22	10/45	..	..	....
63	O. S.	27	6/44	44	18	+26	5/46	39	20	+19
64	H. M.	20	7/44	35	12	+23	3/46	30	10	+20
65	M. C.	36	10/44	50	11	+39	3/46	45	6	+39
66	J. M.	26	11/44	52	20	+32	10/45	48	12	+36
67	J. S.	20	11/44	51	22	+29	3/46	54	13	+41
68	R. P.	31	11/44	40	18	+22	2/46	31	16	+15
69	R. W.	30	11/44	43	22	+21	3/46	32	17	+15

TABLE 1.—*Hearing Survey in Cases 1 to 100 (Successful Results in 80)—Continued*

Number	Name	Age	Date of Operation	Pure Tones,* Before	After	Gain	Last Test	Speech † Before	After	Gain
70	M. M.	29	12/44	53	17	+36	3/46	48	24	+24
71	J. F.	40	1/45	38	13	+25	3/46	37	12	+25
72	W. J.	34	1/45	46	20	+26	4/46	34	14	+20
73	S. G.	38	1/45	39	15	+24	4/46	39	14	+25
74	H. A.	22	2/45	48	17	+31	4/46	36	20	+16
75	E. S.	23	2/46	50	13	+37	10/45	39	11	+28
76	H. K.	24	4/45	35	23	+12	2/46	31	16	+15
77	E. S.	30	4/45	45	17	+28	4/46	43	21	+22
78	M. L.	26	4/45	35	23	+12	3/46	31	16	+15
79	D. L.	20	5/46	38	15	+23	2/46	34	21	+13
80	E. P.	33	5/45	55	27	+28	3/46	50	20	+30
81	E. M.	40	5/45	52	22	+30	2/46	50	24	+26
82	S. G.	36	5/45	51	25	+26	2/46	46	23	+23
83	M. R.	20	6/45	50	20	+30	....	..	..	....
84	J. C.	26	6/45	50	21	+29	3/46	48	19	+29
85	J. B.	45	6/45	55	28	+27	12/45	..	..	....
86	N. T.	41	9/45	51	22	+29	3/46	33	17	+16
87	R. J.	35	9/45	47	26	+21	4/46	..	..	....
89	H. T.	29	9/45	45	15	+30	4/46	40	7	+33
90	J. H.	31	9/45	39	20	+19	4/46	33	11	+22
91	P. M.	25	10/45	32	15	+17	3/46	28	12	+16
92	W. B.	27	10/45	35	20	+15	4/46	28	..	....
93	S. M.	40	10/45	54	20	+34	4/46	36	14	+22
95	W. D.	36	11/45	47	18	+29	....	..	..	....
96	W. P.	24	11/45	51	15	+36	5/46	..	..	....
97	M. C.	33	12/45	57	23	+34	4/46	..	..	....
98	M. F.	45	12/45	40	12	+28	5/46	..	..	....
99	C. F.	41	12/45	42	15	+27	5/46	39	8	+31
100	W. J.	25	12/45	33	10	+23	5/46	..	..	....

* Pure tone figures denote hearing loss average of C2, C3 and C4.
† Speech figures denote threshold hearing for numbers on phonograph records.

TABLE 2.—*Hearing Results in 80 Cases*

		Decibels
A	Average hearing loss for pure tones preoperatively	47.3
	Average hearing loss postoperatively	18.8
	Average hearing improvement	28.5
B	Threshold hearing for speech:	
	Average hearing loss preoperatively	38.8
	Average hearing loss postoperatively	15.3
	Average hearing improvement	23.5

One patient had a traumatic rupture of the ear drum from a snowball. It healed, with no loss of hearing.

One patient enlisted and served in the artillery for three years, with a consequent loss of hearing for speech averaging about 10 decibels for both ears; the loss in the ear operated on and in the ear not operated on was similar and most pronounced between 2,000 and 4,000 cycles.

TABLE 3.—*Closure of Fenestra*

Temporary hearing improvement obtained, with loss of fistula response

Case Number	Name	Age	Date	Signs of Closure	Complete, Months	Possible Contributing Factors	Revision	Result	Comment
1	J. N.	33	6/40	3 mo.	5	Influenza 2½ mo. post-operatively	No	.....	
7	E. H.	28	7/41	6 wk.	3	Acute sinus infection 1 mo. postoperatively	12/41	Closure 6 wk.	Membranous horizontal canal removed; hearing maintained at preoperative level
11	K. R.	22	10/41	3 mo.	4	.....	10/42	Closure 4 mo.	Possible puncture of labyrinth
13 *	W. R.	34	11/41	3 mo.	5	Closure of eustachian tube with fluid in middle ear 2½ mo. postoperatively	2/43	Successful 3 yr.	
32 *	A. J.	34	10/42	9 wk.	4	.....	11/43	Successful 2½ yr.	
33	M. S.	17	10/42	10 wk.	3	.....	No	.....	
39	D. L.	25	3/43	2 mo.	6	.....	No	.....	
43 *	J. B.	29	6/43	3 mo.	4	.....	7/44	Successful 2 yr.	
47	J. M.	24	11/43	1 mo.	2	Membranous labyrinth punctured	10/45	Closure 6 wk.	Membranous labyrinth torn; hearing maintained at preoperative level
88	A. C.	22	9/45	2 mo.	3	.....	.....	.....	

* Reported with successful results.

TABLE 4.—*Fibrosis or Damage to the Labyrinth*

Case Number	Name	Age	Date	Pure Tones			Last Test	Speech			Comment
				Before	After	Change		Before	After	Change	
4	A. G.	40	12/40	44	43	0	6/44	34	34	0	Fistula reaction active; slough of portion of flap following operation
8	B. M.	28	8/41	50	38	+12	4/46	39	34	+5	Slight improvement but with distortion of sounds; membranous horizontal semicircular canal caught by suction tip and removed at operation; negative fistula reaction
20	R. R.	30	2/42	58	75	—17	3/45	..	..	...	"Malignant" otosclerosis; red middle ears; operation revealed entire labyrinth overgrown with red, spongy bone; fistula test active; similar hearing loss in ear not operated on
22	M. W.	20	4/42	42	33	+ 9	1/45	33	30	+3	Nasal allergy; fistula test active; closure of eustachian tubes with secretory middle ears on 2 occasions; probably some fibrosis
45	M. B.	34	10/43	53	68	—15	1/46	43	50	—7	Paraffin used in cavity; on removal on seventh day, flap appeared bluish; probable intralabyrinthine bleeding; moderate vertigo for 10 days; probable closure of fenestra; fistula reaction negative
53	C. C.	35	2/44	57	64	— 7	3/46	42	51	—9	Blood seen beneath flap on removal of paraffin; fistula test active; some vertigo for 1 yr. postoperatively
64	E. E.	31	5/44	46	62	—16	1/46	..	..	...	Extremely allergic; hay fever and hives; hearing improved 1 mo.; aspergillus infection 1 mo. postoperatively; hearing improvement lost; fistula reaction active; 1 yr. postoperatively typical hydrops of labyrinth, fluctuating hearing, diplacusis and tinnitus plus acute attacks of vertigo developed; controlled with nicotinic acid; tragic case

TABLE 5.—*Hearing Improvement Below Practical Level*

Case Number	Name	Age	Date	Pure Tones			Last Test	Speech			Comment
				Before	After	Improvement		Before	After	Improvement	
2	F. M.	32	7/40	54	35	+19	6/45	..	30	...	Unsuitable for operation; bone conduction loss average 25; nerve deafness to high tones
3	F. S.	28	9/40	52	35	+17	3/46	..	30	...	Practical speech hearing maintained 3 yr.; enlisted in artillery; 3 yr. service resulted in equal hearing loss in both ears of 15 decibels in upper scale
16	E. P.	33	12/41	49	35	+14	4/46	35	30	+5	Fibrosis resulting from partial sloughing of flap prevented good hearing improvement; patient wears hearing aid
35	A. W.	29	12/42	56	33	+23	4/45	41	28	+13	Probable cochlear involvement by otosclerotic process; red middle ears; low hearing level at 512 and 1,024 db.; unsuitable patient; wears hearing aid
44	G. E.	37	7/43	67	40	+27	3/46	50	30	+20	Similar to case 35; poor bone conduction at 512 and 1,024 db.
94	E. T.	43	10/45	65	46	+19	4/46	59	..	...	Unsuitable for operation; poor bone conduction tests; tones probably heard in opposite ear, which showed much higher hearing level

There have been seven pregnancies in this series since operation, with no appreciable loss of hearing in either the ear operated on or in the one not operated on.

In 1 patient dementia precox developed three months following operation. This was found to be due to the fact that he was rejected for military service following operation, although he had good hearing. It was learned that the only reason he submitted to operation was to enable him to get into the Army. He was successfully treated with shock therapy.

CONCLUSION

The fenestration operation has proved to be relatively free from serious risk. It is a gamble at best, and one cannot predict when an operation will prove to be a failure. However, with improved technic, experience and understanding, the percentage of failures has decreased from year to year. The successful restoration of practical speech hearing can definitely be attained in properly selected patients. Moreover, this improvement in hearing can be maintained over a period of years. The psychologic storm is terrific, and I know of no happier persons than those in whom practical hearing has been restored. On the other hand, it is a great tragedy to attain good hearing temporarily and then to lose it. The persons who get only a partial improvement of hearing below the practical level are usually dissatisfied and unhappy, and it is doubly difficult to persuade them to wear a hearing aid. This is still a young field of endeavor, and it is only through experience and experiment that perfection may be gradually approached though it may never be reached.

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STENOSIS OF THE LARYNX OF LIMITED EXTENT

Simplified Treatment

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A RECENT article extols the use of acrylic obturators in conjunction with tracheostomy or laryngostomy in the treatment of laryngeal or tracheal stenosis.[1] Experience in the case reported in this paper confirms observations in that article. It also shows that tracheostomy and laryngostomy may be unnecessary in cases in which stenosis is limited in extent. Wounds from shrapnel or other war injuries may cause webs and other forms of limited stenosis which will respond to the simplified procedure described. Successful epithelization under a properly prepared splint can be expected to take place and reformation of obstructing bands prevented. It is probable that the decrease in manipulation of tissues in this method minimized the incidence of chondritis and other complications from infection.

REPORT OF A CASE

A 22 year old pilot stumbled on a foot locker on the night of June 10, 1945 and, falling in the dark, struck the front of his neck on the iron rail at the foot of his cot. He was breathless for a short time and bled from the mouth for two hours. Examination at the dispensary disclosed no emergency, and he was referred to the Ear, Nose and Throat Clinic at Dale Mabry Station Hospital. The next morning he was still spitting blood; this continued for two weeks, and he had had no voice since the accident. The larynx was tender, and mirror examination showed diffuse edema and ecchymosis of the pyriform fossae and arytenoids obscuring the cords. A diagnosis of fracture of the larynx was made.[2]

Early administration of penicillin and palliative treatment did not prevent continuing edema and slowly increasing stenosis. Within three weeks there was considerable decrease in the airway and slight shortness of breath on exertion. Indirect examination showed the anterior half of the larynx occupied by swelling from a subperichondrial hematoma or edema. This mass crowded the intrinsic musculature and other structures into the posterior part of the larynx, distorting the cords and ventricles into irregular but relatively symmetric masses. Roentgenograms at this time showed definite increase in the soft tissue, reducing the laryngeal airway 60 per cent.

One month after the accident breathing difficulty was still increasing, and the patient was transferred to Drew Field Regional Station Hospital. On July 10 a

1. Erich, J. B.: Treatment of Extensive Cicatricial Stenosis of the Larynx or the Trachea, Arch. Otolaryng. **41**:343 (May) 1945.

2. The early care of this patient was carried out by Major C. S. McLemore, who permitted this publication.

tranquil tracheotomy was performed to put the larynx at rest. (Sulfadiazine was given for six days.) On July 25, though the airway continued narrow, the edema was disappearing and the arytenoids were recovering a normal appearance. By the middle of August, after an uneventful course, the subsiding edema restored the arytenoids to a nearly normal appearance, but, instead of further improvement in the airway, a cicatrix had formed between the false cords, which gradually extended backward until only a pinpoint opening at the posterior commissure remained.

No infection had been evident at any time, and the laryngeal tissues appeared to have reached a quiescent state (fifteen weeks after the injury and eleven weeks after tracheotomy). Roentgenograms were retaken after insufflation of bismuth subnitrate into the trachea below the stenosis and also on the surface of the cicatrix from above. The resulting plates indicated that the stenosis was not a heavy one (in spite of being almost complete).

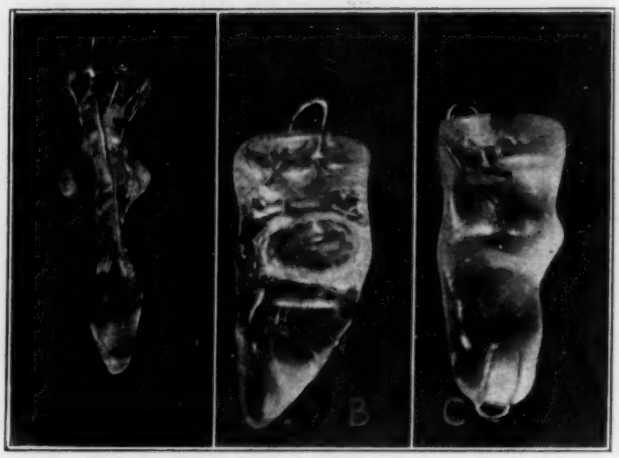

Fig. 1.—*A*, anteroposterior view of acrylic mold used in this case. *B*, lateral view. *C*, mold prepared for reinsertion with loop at lower pole to prevent ejection by cough. (Official photograph by United States Army Air Corps.)

A series of laryngoscopies was done September 2, 10, 19 and 24 to gain the patient's confidence and cooperation to the fullest and to condition the larynx to instrumentation as a preventative of traumatic perichondritis.

A mold of a normal laryngeal airway was made from a cadaver, remade in wax and trimmed to suit the needs of this particular larynx. This wax model was cast in clear acrylic, with a loop of dental wire for a proximal handle and a silk cord attached to prevent swallowing.

The acrylic was cut around the wire with a dental drill to make a solid grasp for laryngeal forceps.

The procedure contemplated was run through with the operating room crew in pantomime. In this way it was discovered that the usual Jackson instruments could not be used, because of the bulk of the model. A Macintosh laryngoscope (Foregger Company) was selected after trial. A laryngeal knife was improvised from the long ear, nose and throat Bard-Parker knife with a no. 11 blade further elongated by grasping the end in a large needle-holder (a small wrap

of adhesive tape covered all but 6 mm. of blade, and another wrap improved the grasp on the handle of the needle holder.)

On Sept. 28, 1945, with the patient under heavy sedation and local anesthesia with 20 per cent cocaine on a sponge, laryngoscopy was performed and partial incision of the stenosis was accomplished with the knife described; however, even after the acrylic model was cut down to a dull point, it could not be inserted. The procedure was abandoned. It was determined that the anterior exposure used in all types of direct laryngoscopy was not sufficient to sever the cicatrix anteriorly with the knife devised for operation. There was minimal bleeding, which was controlled with an epinephrine sponge. The patient attended a football game the next day.

On October 1, three days later, with the patient under heavy sedation and cocainization, the stenosis was completely divided under indirect vision, a no. 12 Bard-Parker blade taped into a Jackson postpharyngeal applicator being used. The curved blade was used because it gave a sliding action against the tough scar tissue which could not be obtained by the straightforward pull on a no. 11 blade. The patient was immediately anesthetized and the obturator inserted.

"By means of a soft rubber tissue (old glove) the tracheotomy was connected to the soda lime canister, providing a to and fro absorption technic for the adminis-

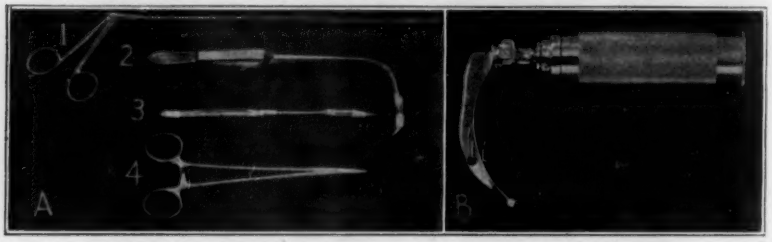

Fig. 2.—*A*, straight forceps for laryngeal grasping (*1*); postpharyngeal applicator with taped no. 12 Bard-Parker blade (*2*); long-handled Bard-Parker knife with taped no. 11 blade (*3*), and large needle holder to grasp taped handle of Bard-Parker knife *4*. *B*, Macintosh laryngoscope, in common use by anesthesiologists. (Official photographs by United States Army Air Corps.)

tration of the anesthetic agent.[3] Cyclopropane was selected because of the rapid pleasant induction and rapid recovery period with no irritating properties. Relaxation was sufficient in approximately four minutes for the acrylic mold to be inserted, and the patient reacted sufficiently to cooperate with the surgeon before leaving the operating room. There was no nausea or excessive reacting through the cough reflex as had been encountered by other drugs accentuating the parasympathetic system."

The silk cord attached to the mold was brought out through the right nostril and taped to the cheek. The ventricular (lateral) processes of the obturator held the mold in place for six days, when disappearance of edema from the operation permitted it to be ejected on cough.

Pencillin was given October 1, 3, 4 and 5. The postoperative course was marked by no untoward reactions. For the first forty-eight hours heavy doses of sedation were given to prevent cough and help to hold the mold in the larynx.

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3. Major Ralph S. Sappenfield, Medical Corps, Army of the United States, anesthetist in this case, submitted the data on the anesthesia used.

To date, the airway has remained open and arytenoid motion is normal. Cord structure is recognizable, and white epithelial or fibrous tissue is notably increasing along their free edges. The other intrinsic musculature shows normal action, though there is a tendency to use the false cords. For this reason every effort is being made to continue vocal rest. It is expected that the voice will be satisfactory when recovery is more complete.

COMMENT

Comment is arranged chronologically, for comparison with other cases which may be reported. It is hoped that suggestions may be forthcoming for procedures which will shorten hospitalization still further.

1. On June 10, 1945 the injury occurred. Early tracheotomy to put the larynx at rest may have been of benefit but probably would not have prevented the stenosis.

2. On July 10 tracheotomy was performed. Sulfadiazine given by mouth undoubtedly contributed to an excellent uncomplicated convalescence. The patient gained 20 pounds (9.1 Kg.) over his usual weight.

3. On September 28 the first definitive treatment was attempted. The leverage through any type of laryngoscope is bad for manipulation of a laryngeal knife in tough scar tissue.

The Jackson laryngoscope is not suitable for direct insertion of a large laryngeal mold. The anesthesiologist's Macintosh laryngoscope, which does not attempt to pick up the epiglottis but lifts it by lifting the tongue and, more important, is open not only on one side but also on the top (dorsal aspect when in use), is superior for this purpose.

4. On October 1 definitive treatment was carried out, within four months of the injury, with safety. An additional safeguard against complications consisted in administration of penicillin. With the patient under sedation and local anesthesia, incision of the scar under indirect vision presented the advantage of: (*a*) better vision because of less laryngeal spasm, which at most times hid the lesion when viewed directly, and (*b*) better leverage for incision, particularly of the difficult anterior portion of the cicatrix.

In other cases, it is proposed that the acrylic molds be prepared with a loop at the distal end to carry a cord which can be picked up and brought out through the tracheal wound if necessary to hold the mold in place.

An additional improvement for insertion of the obturator may be the incorporation of an intubation tube or its grasping mechanism in the top of the acrylic so that the intubation handle (direct or indirect) can be used.

The one disadvantage noted by Erich, "They necessitate a large tracheal opening," is obviated.

This young athletic adul, with a full set of perfect teeth, a large tongue and short neck, had continued exercising and had put on 20 extra pounds (9 Kg.) during hospitalization. General anesthesia with cyclopropane was ideal in obtaining the relaxation necessary for the direct insertion of the obturator in his case. It cannot be emphasized too strongly that the type of sedation and anesthesia must receive extremely special consideration in operations in which blood and secretions may accumulate in the tracheobronchial tree.

Two war injuries of the larynx have been seen, with small relatively asymptomatic webs, which did not warrant this type of care, but, with modifications of the mold permitting adequate airway in the acrylic and handling like an intubation tube, it might be possible to treat these and patients with early cases of laryngeal injuries in a similar way, to prevent webbing or to restore normal function without even a tracheotomy.

ADDENDUM

On Oct. 6, 1946 information was received from the patient whose case is reported that he has returned to flying; that he is an instructor, and that he has passed all Army physical examinations, but that he is "sharply limited in the volume of my speech, and a slight hoarseness persists."

THE ALLERGIC NOSE

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SOME observers maintain that the incidence of allergic conditions is increasing. Whether this is true or whether the apparent increase is due to a medical profession more conscious of this malady and possessing better facilities for diagnosis is debatable. Regardless of the merits of this question, many allergic patients, on account of the nature of their symptoms, first consult the otolaryngologist. It is, therefore, his duty to be able to recognize this condition and to recommend proper therapeutic procedures.

With the exception of acute, subacute and chronic infections, allergy is the commonest cause of nasal symptoms. A physician should always look with suspicion on the patient, adult or child who has a constant nasal cold. Some years ago, in writing on this subject, I classified the allergic nose in five categories, and since that time I have seen no reason for changing this classification. The patients will always fall into one of the following divisions: (1) the patient with suspected allergy, (2) the patient with definite allergy without demonstrable sinus infection, (3) the patient with definite allergy with sinus infection, (4) the patient with definite allergy with polyposis and (5) the patient with definite allergy with polyposis and sinus infection.

The allergic suspect has a history of perennial nasal discomfort, which is almost always called a "cold" by the patient. Here a careful history is of utmost importance. This history should not be limited to nasal symptoms but should consider the possibility of other allergic manifestations. It has been estimated that 70 per cent of allergic patients show a multiple allergic response, so that one can expect a history of urticaria, eczema, migraine, asthma, gastrointestinal disorders or vertigo in all but 30 per cent of the cases of allergy. The family history, too, should be investigated.

The patient with a suspected allergy objectively does not show the typical pale, boggy, edematous mucosa with the excessive mucoid discharge and tendency to resist shrinkage. Between attacks the membranes may appear to be normal. During attacks one cannot grossly differentiate the condition from the early stages of acute coryza. These

Read at the meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society, Inc., Boston, Jan. 9, 1946.

cases must be carefully studied to determine the presence or absence of infection.

In true nasal allergy uncomplicated by infection, nasoscopic study after shrinkage will not reveal pus escaping from any of the sinuses nor will a purulent discharge be found on the floor of the nose or nasopharynx. If such discharge is found, one may be sure that a complicating infection exists. Nasal cultures are of great value in determining whether infection is a complicating factor. Sterile cultures are frequently obtained from the purely allergic nose, or if organisms are reported they are of no pathologic import. If Pneumococcus, Streptococcus, Staphylococcus aureus or influenza organisms are found, one must assume that infection is present and the patient becomes an allergic suspect, with the condition complicated by infection. A fairly high percentage will show eosinophils in smears of nasal secretions. Absence of these cells does not eliminate the allergic possibility. Roentgenograms of the sinuses of these patients are not of great value, because abnormal findings will certainly be reported. The ethmoid cells will be clouded and the antrums show thickened membranes at least. The difficulty here lies in the fact that from these roentgenograms one cannot tell how much of this condition is due to the allergic response and how much is secondary to infection. I do not believe that any roentgenologist can tell us when a sinus is clouded by the one and when by the other.

Sometimes some simple measures on a hit or miss basis will secure results in these allergic suspects. The enclosure of pillows and mattresses in dustproof casings, the use of nonallergic cosmetics, the elimination of household pets and other measures may be given a trial. Diagnostic help may sometimes be secured by therapeutic trial of ephedrine, atropine and barbiturate combinations taken by mouth. The conditions of a few of these patients will improve if they stop entirely the use of "nose drops" or inhalers which they may have been using too liberally. Some good results have been reported following the use of injections of histamine and nicotinic acid. Most of these conditions, however, tend to relapse on cessation of treatment. In some instances ascorbic acid in high dosage is said to be of value. Benadryl in appropriate dosage will benefit a considerable number of these patients. The rhinologist may justifiably try these procedures, but if they fail to produce results a complete allergic survey by a trained allergist should be obtained.

The experienced rhinologist will rarely fail to diagnose properly the definite allergic patient of class 2. In this class is found the typical pale, boggy, swollen mucosa, the profuse mucoid discharge and the history of nasal blockage and sneezing frequently associated with a family history of allergy or other allergic phenomena occurring in the patient himself.

An allergic survey of this patient is desirable, and his life and habits should be regulated on the basis of these findings. Immunization ther-

apy should be followed when possible along with any of the therapeutic measures mentioned.

In the allergic nose complicated by sinus infection, elimination of the infection is of primary importance. This is by no means easy. If large nonreversible polyps are present, they should be removed. Badly deflected nasal septums must be surgically corrected. Large pneumatic middle turbinates may call for removal. Ethmoid and sphenoid sinuses may demand surgical attention. Infected maxillary sinuses must be irrigated, and many demand operation before control of chronic infection can be secured. If the infection is of long standing and chronic in nature, antibiotic and sulfonamide therapy usually gives only temporary relief if any. Improvement of ventilation and drainage are the primary objectives in this type of sinus disease, as in other types of sinus infections, but here they are usually much more difficult to obtain.

Therapy along allergic lines all too often fails to secure satisfactory results. This, however, should not condemn allergic tests and treatment, as there are enough successes, in full or in part, to more than justify their continuation. Some other measures can be used to give comfort to allergic patients who have failed to be relieved by other measures. All such treatment aims to secure some formation of scar tissue in the nasal erectile tissues, especially of the inferior turbinates. The use of the galvanic current applied to an electrolyte in the nose is not looked on with favor, although many satisfactory cures have been reported. This treatment distributes its sclerosing effect throughout the entire nasal chamber and sometimes gives rise to anosmia. Just as good results can be secured by more localized treatment. The bipolar nasal electrode using electrocoagulating current applied to all redundant tissues of the inferior turbinate is effective and easy to apply. The best results by this method are obtained by applying the electrodes to the surface mucosa rather than by embedding them in the tissues. Sclerosing solutions injected under the mucosa, too, give satisfactory shrinkage. The best of these are 5 per cent solution of sodium morrhuate or sylnasol (5 per cent solution of the sodium salts of certain fatty acids from oil extracted from the seed of the psyllium group). Many patients so treated are troubled little by nasal blockage for long periods, varying from months to years.

In spite of all these methods of procedure outlined, it must be remembered that all allergic nasal problems are difficult problems. Each is a law unto itself, and that which works wonders in one may fail in another. Teamwork between rhinologist and allergist is of the utmost importance, and, where such a relationship exists, as a rule at least some relief can eventually be obtained for the patient with this most distressing and annoying ailment.

Case Reports

SCHWANNOMA OF THE PHARYNX WITH PARALYSIS OF THE VOCAL CORD

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A SCHWANNOMA is an encapsulated, nodular, slowly growing, vascular, usually benign tumor arising within or on the side of a nerve trunk and is believed to originate from the cells of the neurilemma, or the sheath of Schwann. It may grow to a large size, but it is painless in character and gives symptoms due to pressure. After complete removal recurrences are rare.

Verocay,[1] in 1910, first described this tumor and termed it a neurinoma. The scanty references in the literature to this tumor in the pharynx bear out Orton's [2] statement that it is one of the rarest tumors of the pharynx. There is no uniformity of nomenclature. It has been variously referred to as a schwannoma,[3] gliofibrosarcoma,[2] peripheral glioma,[2] solitary neurofibroma,[4] perineural fibroblastoma,[4a] neurofibroma,[5] neurinoma [5] and neurilemmoma.[6]

Ewing [1] stated that the Schwann cells contribute to most of the growth but that the endoneural cells also multiply and concentric groups of cells come from the lamellar sheaths. Microscopic section of the entire tumor shows a distended epineurium as a capsule, within which are found the palisading units of cells. These sheaths of hyperchromatic elongated spindle cells, with their peculiar palisade arrangement, are the characteristic diagnostic feature in the microscopic study.

The case to be presented is unique in the fact that, in retrospect, one can see that the tumor caused a paralysis of the right vocal cord five years before a tumor mass was ever recognized or considered.

Read before the Bridgeport Medical Association on Dec. 4, 1945.

1. Ewing, J.: Neoplastic Diseases, ed. 4, Philadelphia, W. B. Saunders Company, 1940.

2. Kernan, J. D.: Surgery of the Nose and Throat, New York, Thos. Nelson & Sons, 1942, pp. 407 and 525.

3. Ewing.[1] Kernan.[2]

4. (*a*) Figi, F. H.: Solitary Neurofibroma of the Pharynx, Arch. Otolaryng. **17**:386 (March) 1933. (*b*) Hall, C., and Owens, H.: Solitary Neurofibroma of the Pharynx, Arch. Otolaryng. **34**:1163 (Dec.) 1941.

5. Hill, F. T.: Neurofibroma of the Pharynx with Paralysis of the Larynx Following Operation, Ann. Otol., Rhin. & Laryng. **53**:326 (June) 1944; personal communication to the author.

6. Ehrlich, H. E., and Martin, H.: Schwannoma (Neurilemmomas) in the Head and Neck, Surg., Gynec. & Obst. **75**:577 (May) 1943.

REPORT OF A CASE

S. C., a housewife, aged 27 years, was first seen on Feb. 5, 1945, with a huge mass in the right tonsillar fossa. Her history goes back to July 1937, at which time the patient lost her voice after swimming. Laryngitis persisted despite treatment by an otolaryngologist. Four years before seen her tonsils were removed, and the laryngeal symptoms abated slightly but never did clear up. Three years before seen the patient noticed a swelling under the angle of the right jaw. In the past year she had noted that while she was in the act of lifting the right shoulder would frequently give out on her. She had had increasing difficulty in swallowing, and a peculiar nasal speech defect had developed. There had been no loss of weight; in fact, the patient had gained a few pounds in the last year.

Examination revealed a mass in the right tonsillar fossa about the size of a hen's egg, which was smooth in character and seemed rubbery in consistency on

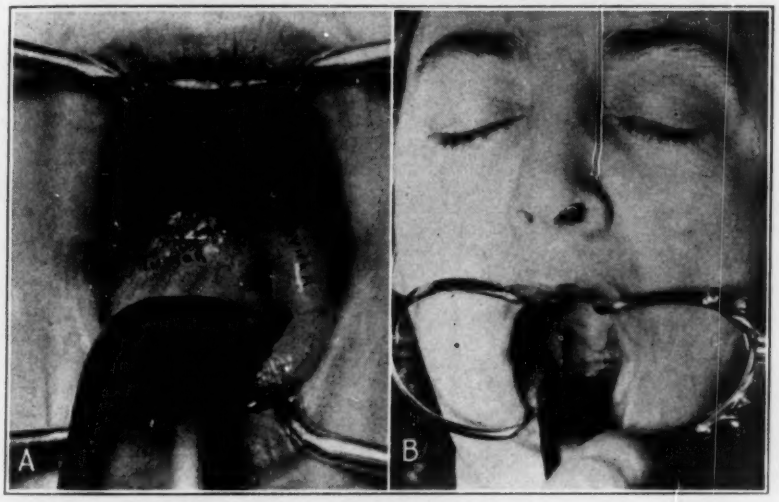

Fig. 1.—*A*, appearance of the throat preoperatively. Note the extent of the tumor mass and the pronounced displacement of the uvula; yet no inflammatory reaction is present. *B*, appearance of the throat following recovery. Note the minimal amount of distortion following recovery.

palpation. It had completely displaced the uvula to the left anterior pillar. A swelling the size of a small plum was present externally under the angle of the right jaw. The ears were normal. The nose showed a deflected obstructing septum to the left side. The larynx showed a paralysis of the right vocal cord, with the right cord in cadaveric position. Results of examinations of urine and blood were normal. The serologic test of the blood gave a negative reaction. Roentgenologic examinations of the neck and chest gave normal results. A diagnosis of mixed tumor was made, the paralysis of the vocal cord being considered a separate, unrelated disease entity.

With the patient under procaine hydrochloride circumferential block anesthesia, an incision was made along the anterior and posterior pillars. From this point on, blunt dissection was employed, a Hurd dissector, Metzenbaum scissors and, chiefly, the finger being used. The densely encapsulated mass was freed anteriorly,

posteriorly and laterally, with little bleeding encountered. The tumor extended far posteriorly under the base of the skull. The mass was so large that a moderate amount of difficulty was encountered in removing it orally. Several lobulated segments were encountered, which came away with the entire mass. A small

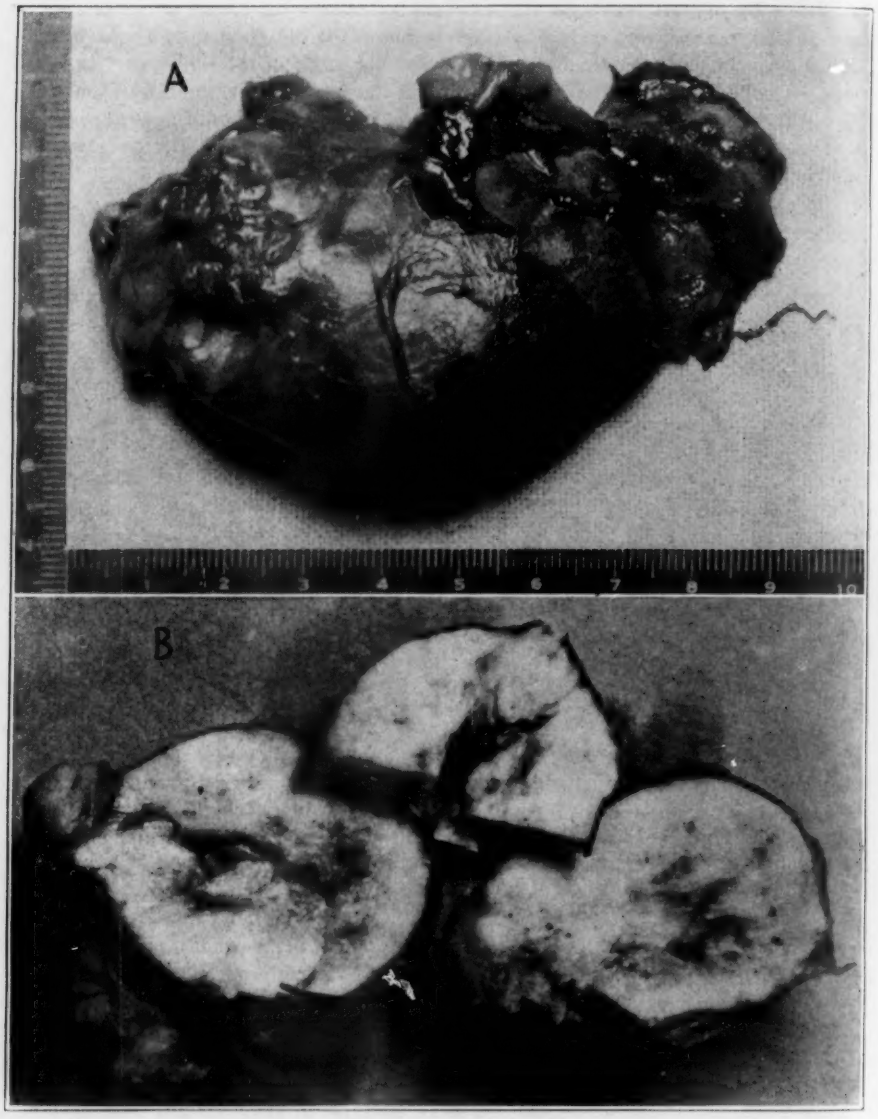

Fig. 2.—*A*, gross specimen, actual size. *B*, cut sections of the gross specimen.

segment at the upper pole remained firmly attached at the base of the skull, far posteriorly, which was removed separately and completely by blunt dissection. Little bleeding was encountered. A small piece of Penrose drain was sutured into the depths of the huge fossa and removed on the second day.

Pathologic Report.—Grossly, the mass weighed 57 Gm., was irregularly lobular in shape and measured approximately 7 by 4.5 by 3 cm. The outer surface of the mass was of a brownish cast, but when sectioned it was of a brownish gray cast. The appearance of the cut section was more or less similar to the interior of a nutmeg. The central area appeared to have a central zone which was split. Near this and extending toward the periphery, many well defined, punctate, brownish and gray areas were also seen. Emanating from the surface of the mass, smaller

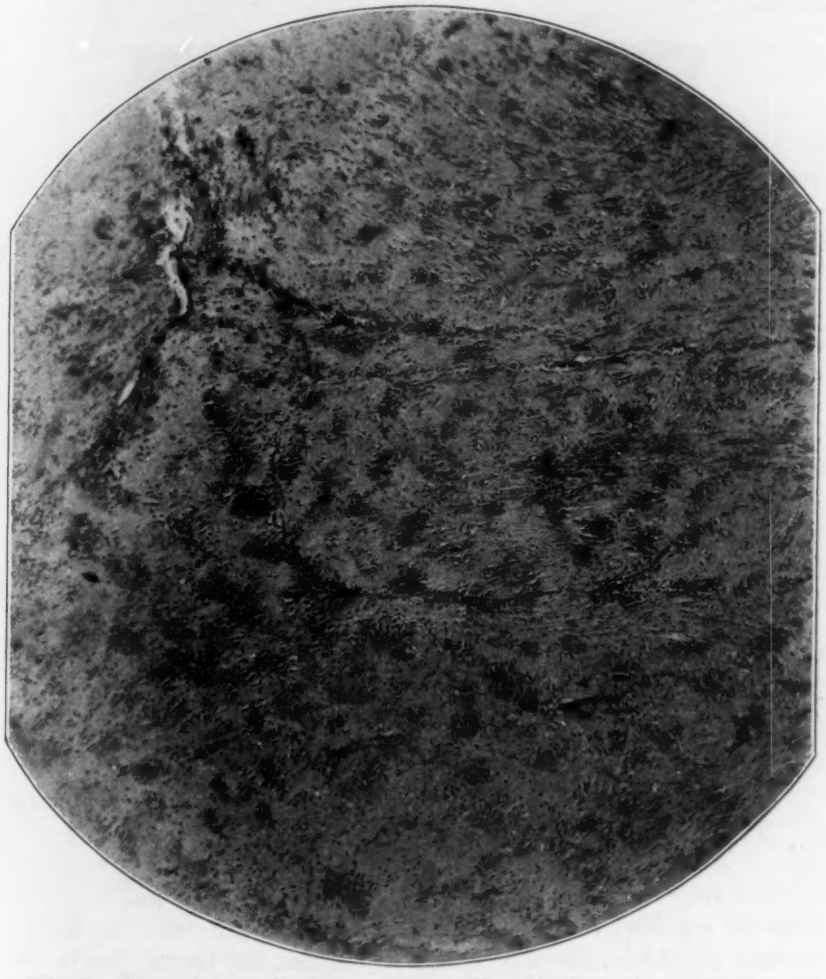

Fig. 3.—Photomicrograph of tumor mass. Note the hyperchromatic elongated cells, with the peculiar palisading arrangement.

masses, one of which measured 1.5 cm., were present. Microscopically, there was a generalized background of reticulum stroma. Implanted throughout this background area were groups or sheaths of hyperchromatic elongated spindle cells, with a characteristic palisading arrangement. No anaplasia was present. The outer zone or capsule was denser and made up of elongated and flattened cells. These were all well defined and presented no loss in continuity. The diagnosis of neurinoma was made.

About the third day postoperatively there developed typical Horner's syndrome in the right eye, characteristic of paralysis of sympathetic innervation (enophthalmos, ptosis of the right lid and contraction of the right pupil). Excluding this complication, the patient made an uneventful recovery, and to date, ten months postoperatively, there has been no recurrence of the tumor. However, Horner's syndrome persists. Paralysis of the right vocal cord, dsyphagia and the speech defect are still present. The weakness in the right shoulder has disappeared entirely.

Fig. 4.—Photograph of the patient postoperatively, showing Horner's syndrome.

COMMENT

This huge tumor extended to the base of the skull and its origin from the trunk of the vagus nerve at its emergence from the jugular foramen is evident. It was in this region that the tumor growth was most adherent. It is in this location that the vagus, spinal accessory and glossopharyngeal nerves and the internal carotid artery are in extremely close relationship. According to Ranson,[7] the intramedullary course of the special visceral efferent fibers of the vagus that terminate in the musculature of the pharynx and larynx occupies the medial external portion of the nerve trunk. It is these fibers that were first involved by

7. Ranson, S. W.: The Anatomy of the Nervous System, ed. 5, Philadelphia, W. B. Saunders Company, 1935, pp. 162 and 169.

the tumor mass, as was evidenced by the paralysis of the right vocal cord. Progressive involvement of the trunk also paralyzed the fibers innervating the pharyngeal and palatal musculature, which produced dysphagia and the disturbance in speech. Pressure from the expanding tumor eventually involved the adjacent spinal accessory nerve, resulting in faulty innervation of the trapezius muscle, which produced the weakness in the right shoulder of which the patient complained.

Horner's syndrome is a complication due probably to a secondary inflammatory reaction following the removal of the tumor, which involved the sympathetic plexus surrounding the internal carotid artery. This plexus is derived from the postganglionic fibers of the superior cervical ganglion, which follow and surround the internal carotid artery and become the sympathetic innervation of the right eye.

Horner's syndrome is not an uncommon complication in this type of tumor, as is evidenced in cases reported by Foster,[8] Hill,[5] Nigro[9] and Viole.[10] Foster, Hill and Nigro reported a disappearance of Horner's syndrome in their cases in a comparatively short time postoperatively (six to eight weeks in Nigro's case). In Viole's case and my case, Horner's syndrome is still present after ten months. Hill's, Nigro's and my case all showed a paralysis of the vocal cord on the same side as the tumor growth. Inasmuch as the paralysis of one vocal cord may be present without the patient exhibiting hoarseness and may be overlooked preoperatively, it is probable that this is a prominent feature in differential diagnosis of these tumors preoperatively.

CONCLUSION

A case of schwannoma of the pharynx is reported, with its point of origin definitely located in the vagus nerve at its exit from the jugular foramen. This case plus 2 other cases (Hill and Nigro) showed unilateral paralysis of the vocal cord. Schwannomas are rare tumors in the pharynx, attain a large size and cause extensive damage by pressure. Only 7 cases have been reported in the literature. Two other cases I know about from personal interviews (Nigro and Viole). Accurate elicitation and evaluation of the signs and symptoms preoperatively should permit an early diagnosis of this lesion prior to its appearance in the pharynx. Early operation utilizing the safer external approach, lateral pharyngotomy, advocated by Orton,[2] should eradicate the tumor and avoid the troublesome complications so frequently encountered.

St. Vincent's Hospital.

8. Foster, J. H.: Ganglion Cell Neuroma of the Pharynx, Tr. Am. Laryng. A. **64**:132, 1942.

9. Nigro, A.: Personal communication to the author.

10. Viole, P.: Personal communication to the author.

BRONCHOLITHIASIS

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BRONCHOLITHIASIS was first reported by Schenck [1] in 1600, but the expectoration of calcareous material has been observed since the time of Aristotle. The condition is not common, as is indicated by the fact than Van Ordstrand, Moore and Harris [2] reviewed the English literature from 1900 to 1941 and found only 26 cases. They reported 2 cases, and, in 1944, 4 more cases were reported, 3 by Tinney and Moersch [3] and 1 by Anderson and MacKay.[4] This makes a total of 32 cases for that period. These reported cases are of broncholithiasis as a clinical entity, in distinction from the various types of intrapulmonary calcification. This does not represent the actual incidence of the condition, as Tinney and Moersch [3] were able to collect 28 cases of broncholithiasis from the files of the Mayo Clinic.

ETIOLOGY

The term broncholithiasis is defined as the formation of calculi in a bronchus, but it has become a diagnostic term for any patient with a bronchial calculus. Some authors employ the terms pneumolith, pulmolith, lung calculus or lung stone for the ones of extrabronchial origin. The development of a broncolith depends on formation of or entrance of a calcareous deposit in the lumen of a bronchus. Schmidt [5] advanced two theories: first, that previous inflammation in the lungs leads to calcification in the peribronchial or peritracheal lymph glands and the mass ulcerates into a bronchus and, second, that calcareous

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Read at the meeting of the Houston Ophthalmological and Otolaryngological Society on Nov. 8, 1945.

From the Department of Otolaryngology, Baylor University College of Medicine, and Hermann Hospital.

1. Schenck, J.: Observationum medicarum, Frankfurt, sumpt. J. Rhodii, 1600, vol. 1, p. 351; cited by Poulalion, S. A. M.: Les pierres du poumon, de la plèvre et des bronches, et la pseudophtisie pulmonaire d'origine calculeuse, Paris, G. Steinheil, 1891.

2. Van Ordstrand, H. S.; Moore, P. M., and Harris, H. E.: Broncholithiasis: Report of Two Cases, Cleveland Clin. Quart. **9**:32-44, Jan. 1942.

3. Tinney, W. S., and Moersch, H. J.: Broncholithiasis, S. Clin. North America **24**:830-838 (Aug.) 1944.

4. Anderson, W. S., and MacKay, J. B.: Broncholithiasis, Dis. of Chest **10**: 427-432 (Sept.-Oct.) 1944.

5. Schmidt, H. W.: Broncholithiasis, Proc. Staff Meet., Mayo Clin. **13**:609-612 (Sept. 28) 1938.

deposits are formed in the bronchial tree, foreign bodies or infected secretions serving as a nucleus. Endobronchial calcereous deposits may occur as the sequela of the irritation and inflammation caused by aspirated foreign bodies. Pendergrass and de Lorimier [6] reported a case in which a tonsillith was aspirated at operation and caused symptoms of broncholithiasis until it was coughed up nine weeks later. Lloyd [7] stated that tuberculosis has been regarded as the disease in which broncholiths are most likely to arise. In a number of cases the condition has been proved to be of tuberculous origin, occurring as calcification in a peribronchial lymph gland and ulcerating into the adjacent bronchus. It is unexplained why some calcified masses remain silent throughout life and others become freed and are expelled. Areas of extrabronchial calcification may occur as a result of other pulmonary infections, such as pneumonia, pulmonary abscess or pulmonary infarction. Occasionally the symptoms develop suddenly and then clear up after expulsion of the stone, and no predisposing disease can be determined.

CLINICAL SYMPTOMS

The symptoms are those of bronchial obstruction, the most prominent being a cough, which is often wheezing in character. If the calcareous deposit ulcerates into the bronchus, it may be ushered in with hemoptysis, varying from streaking to frank and copious hemorrhage. At the time of erosion there is pain in the parasternal region, sharp and boring in character, with associated thoracic oppression and substernal constriction. This is often followed by a decided febrile reaction. The symptoms and clinical findings depend on the size and shape of the calculus, the degree of bronchial obstruction and the secondary changes distal to the obstruction. If the obstruction is complete or almost complete, it may be followed by pulmonary abscess or bronchiectasis. When the lumen is only partially obstructed, there are frequently paroxysms of coughing, with wheezing and expiratory dyspnea; hence the term "stone asthma." There is usually excessive secretion of mucus, which has been described as "bronchorrhea." The loss of weight is not extreme, usually being in proportion to the loss of sleep caused by the paroxysms of pain and coughing. The calculus may be expelled spontaneously and the symptoms entirely disappear.

The calculi vary in size, shape and consistency. They are usually grayish white in color but may show black areas, due to deposits of anthracosis. Most are hard and gritty, but occasionally they are soft

6. Pendergrass, E. P., and de Lorimier, A. A.: Broncholiths and Stone Asthma, Radiology **25**:717-722 (Dec.) 1935.

7. Lloyd, J. J.: Broncholiths, Am. J. M. Sc. **179**:694-699 (May) 1930.

and putty-like. The stones may be single or multiple. Elliott [8] reported a case of a patient who expectorated a total of fifty-six calculi. There are several cases reported in which it has been estimated that patients coughed up between four and five hundred stones. Usually the calculi are rough and irregular, but they may be faceted when they are multiple. According to Wells,[9] their chemical composition is 85 to 90 per cent calcium phosphate and 10 to 15 per cent calcium carbonate.

DIAGNOSIS

The diagnosis of broncholithiasis is made in the majority of cases after the stone has been expelled in a paroxysm of coughing. The patient in a typical case may be seized by an attack of coughing, expiratory dyspnea and asthmatoid wheezing, which is followed by pain, hemoptysis and coughing up of the stone. In the absence of the history of expelling a stone, the diagnosis may be suspected from the history, physical findings and roentgenologic findings. Roentgenographic examination is usually of great value in the diagnosis; however, small areas may be hidden behind the heart or rib shadows. It is difficult to determine whether a calcareous deposit is in the lumen of a bronchus unless a study is made with iodized poppyseed oil. Bronchoscopy is a most important aid in confirming the diagnosis. Ballon,[10] in "Surgical Diseases of the Chest," published in 1935, stated that broncholithiasis is a condition rarely seen by the bronchoscopist, particularly broncholithiasis amenable to bronchoscopic treatment. He mentioned successful results of Tucker, Jackson and Hajek. Bronchoscopic examination is far from infallible, as illustrated in a case reported by Maytum and Vinson,[11] which was considered a bronchial carcinoma until the broncholith was expelled spontaneously. In a few cases exploratory operation is performed before the diagnosis is confirmed, and in others the condition is not suspected until found at autopsy. The differential diagnosis should include bronchial asthma, bronchiectasis, bronchitis, pneumonia, bronchial malignant growths and pulmonary abscess.

TREATMENT

The treatment consists in measures to dislodge the obstructing calculi. The various expectorants and postural drainage exercises are of

8. Elliott, A. R.: Broncholithiasis, J. A. M. A. **79**:1311-1314 (Oct. 14) 1922.

9. Wells, H. G.: Calcification and Ossification, Arch. Int. Med. **7**:721-753 (June) 1911.

10. Graham, E. A.; Singer, J. J., and Ballon, H. C.: Surgical Diseases of the Chest, Philadelphia, Lea & Febiger, 1935.

11. Maytum, C. K., and Vinson, P. P.: Pulmonary Calculus Simulating Primary Bronchial Carcinoma: Report of a Case, M. Clin. North America **15**:1551-1553 (May) 1932.

little value. In all cases in which broncholithiasis is suspected, a bronchoscopic examination should be made. If the stone is present and of removable size, it should be extracted with forceps. This procedure is not without danger; pneumothorax or serious hemorrhage may occur as a complication. Myers [12] reported a fatality in which a calculus had eroded a fairly large artery in the bronchial wall. Sulfonamide or penicillin therapy is indicated for patients having any type of suppurative pneumonitis beyond the obstruction. Thoracic operation such as lobectomy or pneumonectomy may be necessary. It is often indicated when the broncholith has caused complete obstruction for a long period and has led to irreparable damage, such as pronounced cicatricial bronchostenosis or bronchiectasis.

REPORT OF A CASE

Mrs. M. W., a white woman, was admitted to Hermann Hospital on March 27, 1945.

The chief complaint was a cough and recurrent fever of fifteen months' duration. Her present illness began with influenza in December 1943. This was followed by a persistent cough, and in October 1944 a high temperature, pain under the left shoulder and a tightness in the chest developed and she coughed a small amount of blood. The diagnosis of pneumonia was made, and she was treated with penicillin. All symptoms but the cough subsided. In February 1945, the fever recurred and the cough became severe. Shortness of breath developed on exertion, her breathing became wheezing in character and the diagnosis of asthma was considered. On March 22, 1945, a sharp pain in the chest developed and she had a severe paroxysm of coughing and raised a large amount of bright blood. Her temperature became high, and any change of position would cause violent coughing. During the entire illness, there was no loss of weight and her appetite remained good.

The past history was essentially noncontributory except for a salpingectomy on the right side, oophorectomy and suspension of the uterus in 1938. She had had two normal pregnancies, and her last menstrual period was in January 1945. Five years before the present illness she had helped care for a brother-in-law who died of tuberculosis.

Physical Examination.—The patient was a moderately obese white woman, coughing severely but otherwise not appearing acutely ill. Her weight was 148 pounds (67 Kg.). The temperature was 100 F., pulse rate 88, respiratory rate 18 and blood pressure 130 systolic and 80 diastolic. Examination of the head and neck gave essentially normal findings except for subjective tenderness over the right maxillary sinus. The heart, abdomen, genitalia and reflexes were normal. The lungs showed expansion limited at the right base anteriorly. There was dulness to percussion at the base of the right lung, both anteriorly and posteriorly. The breath sounds were decreased at the base of the left lung and absent in the base of the right lung. Fine moist rales were present in the upper lobe of the right lung and at the base of the left lung.

Laboratory Examination.—There were 4,310,000 red cells and 12,250 leukocytes. The Kolmer reaction was negative. The sputum was negative for tuberculosis bacilli on five examinations.

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12. Myers, D. W.: Broncholithiasis, Dis. of Chest **6**:269-272 (Sept.) 1940.

Roentgenologic Examination.—"There was consolidation of the middle lobe of the right lung, with some irregular diminished aeration in the anterior portion of the lower lobe of the right lung. The right side of the diaphragm was elevated. The heart showed slight displacement to the right but otherwise was normal. The upper lobe of the right lung and the entire left lung showed normal aeration. There was a dense calcification measuring 1 by 1.4 cm. in diameter just to the right of the midline in the region of the right main stem of the bronchus. The changes in the middle lobe of the right lung, with the cardiac displacement, evidenced an atelectatic process with infection. No opaque foreign bodies other than the calcified gland were visible."

Fig. 1.—Broncholith removed at bronchoscopy. The rule shows its measurement in centimeters.

The differential diagnosis included pulmonary abscess, bronchial asthma, bronchiectasis, atelectasis, pneumonitis of the base of the right lung and tuberculosis. The patient was examined by bronchoscopy on April 6, 1945. The larynx, trachea and left main bronchus were normal. Examination of the right main bronchus revealed a calcareous mass surrounded by granulation tissue, obstructing the lumen just above the orifice of the middle lobe of the bronchus. The foreign body was removed and found to be a grayish white, rough irregular calculus about 1 cm. in diameter.

Pathologic Report.—"The specimen was a rough, densely calcified body, of stony hardness. A little black discoloration on the surface was evidently anthracosis. The specimen was believed to be a calcified tuberculous bronchial node."

Further questioning revealed that the patient had coughed up a similar but smaller calcified mass while being treated for pneumonia in October 1944. However, she did not show it to her physician. After removal of the broncholith the patient showed rapid improvement; the fever and cough subsided in a few days. Roentgenologic examination on April 9, 1945, showed removal of the calcified mass and better aeration of the middle lobe of the right lung. The patient was discharged from the hospital on April 15, 1945 and has had no recurrence of her symptoms. A roentgenologic examination on July 10, 1945 showed the lungs to be essentially normal.

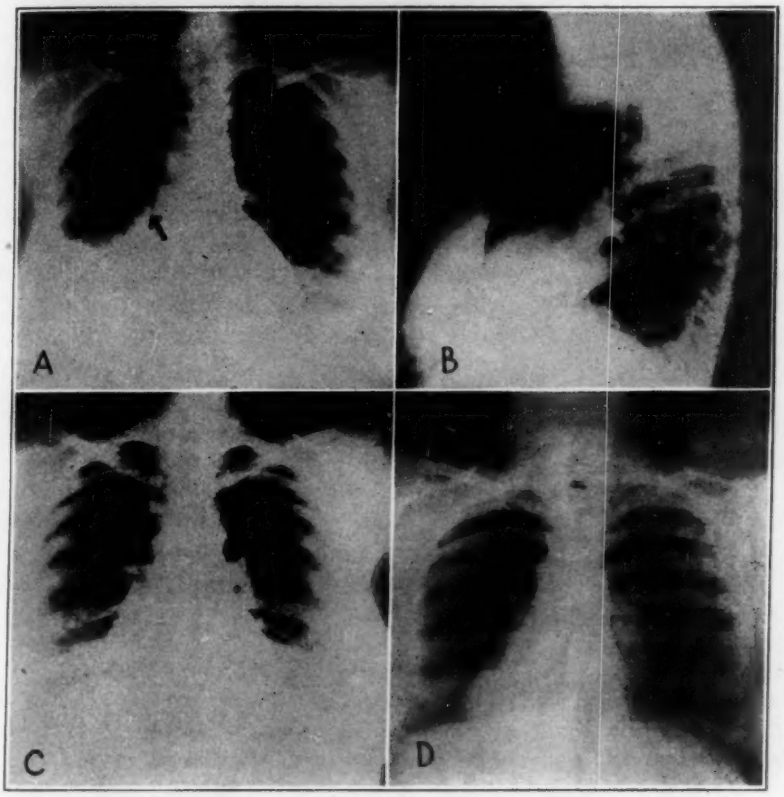

Fig. 2.—*A*, roentgenogram of the chest, anteroposterior view, before bronchoscopy, showing the broncholith and consolidation of the lower part of the right lung. The arrow marks the position of the calculi. *B*, lateral view before bronchoscopy, showing the broncholith and consolidation of the middle lobe of the right lung. *C*, roentgenogram three days after bronchoscopy, showing the calcified mass removed and better aeration of the middle lobe of the right lung. *D*, roentgenogram of the chest on July 10, 1945, showing a normal chest. This plate was made on paper film and shows the reverse of the other roentgenograms.

COMMENT

Although broncholithiasis is considered a rare condition, it probably occurs much more frequently than it is diagnosed. A careful history

will occasionally disclose that hard or gritty material has been coughed up. In the case reported, this point was missed in the history but was brought out after the second broncholith was extracted. The condition is often associated with tuberculosis but may occur in a patient with no evidence of tuberculous infection. Any case of persistent cough should suggest the disease; careful roentgenologic study and bronchoscopic examination should be made. The prognosis is usually good but there is no known way of preventing recurrence. Dramatic results follow removal of the broncholith, but if it remains in the bronchus it may cause bronchiectasis or pulmonary abscess.

1304 Walker Avenue.

FOREIGN BODY IN THE ESOPHAGUS

EDGAR M. HOLMES, M.D., BOSTON

SLENDER piercing foreign bodies of the esophagus are not uncommon, but those that penetrate and enter the structures of the neck are, fortunately, comparatively rare. Prior to the advent of chemotherapy, it was common to have these piercing foreign bodies create a mediastinitis. If the patient was to survive, either the abscess was entered through an esophagoscope or, if better surgical judgment was used, it was entered through a lateral exposure in the neck.

Recently there have been two foreign bodies with which I am familiar that have buried themselves in the neck and have become walled off and inert. The case which is presented here is unusual in that the foreign body was a fine steel wire which did not remain isolated and which gradually worked its way through the tissues to present itself beneath the skin, where it was readily extracted.

REPORT OF A CASE

A boy aged 10 felt a piercing sensation in his throat while eating apple pie at a restaurant. It continued to bother him, causing moderate pain on swallowing, but did not interfere with his eating. Since he believed that it would disappear, a doctor was not consulted until the following day. At that time a roentgenogram was taken, which showed a fine opaque object about 1¼ inches (3 cm.) long at the left of the midline and at the level of the junction of the fourth and fifth cervical vertebrae. It was directly transverse (fig. 1 *A* and *B*).

At this time, there was already a moderate amount of swelling of the soft tissues of the esophagus and of the prevertebral space extending up toward the nasopharynx. The patient was immediately given penicillin. An examination was made of the area, and no foreign body could be seen. The case was then referred to me, and the following day roentgenograms were taken, which showed a slight increase in the swelling of the soft tissue but showed the foreign body in the same position. It seemed advisable to examine the hypopharynx and esophagus again, as the patient was having considerable pain on swallowing, which would indicate that the foreign body was pressing on sensory nerves near the mucosa, though it could have been and probably was an inflammatory reaction due to the infection plus trauma of the previous examination.

The boy at this time seemed in excellent condition. The temperature went no higher than 100 F., and his white cell count was 15,000. With the patient under ether anesthesia, the hypopharynx was examined. It appeared that the arytenoid on the left side was slightly swollen, as was the piriform sinus on that side. There was also a little ecchymosis plus a questionable area where the foreign body might have entered. Below it, the esophagus was found to be perfectly normal.

As the foreign body was not seen, a powerful magnet was introduced near the area of edema, in the hope that the tissue could be seen to draw toward it, but no motion of tissue resulted. It was decided to leave the foreign body alone, give adequate doses of penicillin and sulfadiazine and watch the tissue reaction and the foreign body by roentgenographic examination. Three days later, roentgenograms revealed no change in the position of the foreign body or evidence of increase in the tissue swelling. His temperature did not go above 100.5 F. He had no difficulty in swallowing, and nothing could be palpated externally.

A week following the esophagoscopy, further roentgenograms were taken, which showed that the foreign body had rotated. The lateral end had migrated

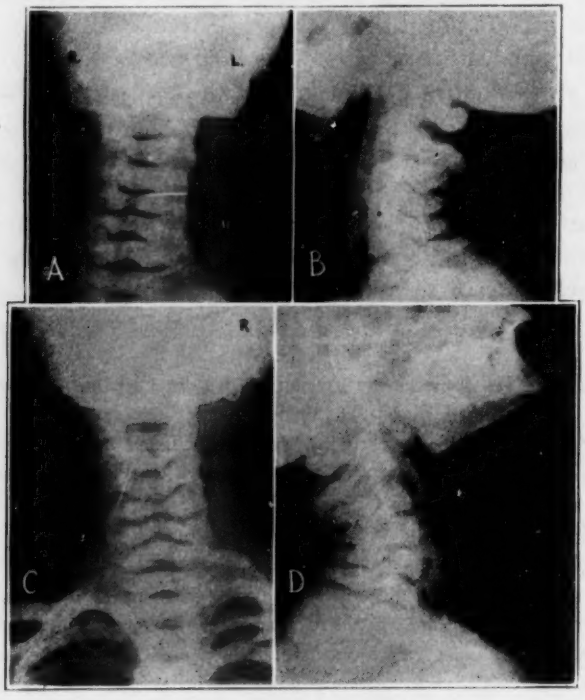

Fig. 1.—*A*, a retouched roentgenogram showing the location of the foreign body in a horizontal position opposite the fourth and fifth cervical vertebrae and to the left of the midline. *B*, a lateral view showing the foreign body just below the piriform sinus with retropharyngeal and esophageal swelling. *C*, an anteroposterior view showing that the outer end of the needle has moved downward and toward the midline. *D*, the foreign body has changed position. One end of it is apparently in the same location but the lower end is anterior and downward. The swelling is changed little, if at all.

down and apparently somewhat anteriorly. The white blood cell count remained at about 14,500. For the next week, no new symptoms developed and nothing could be felt by palpation, but another roentgenogram showed that the foreign body had migrated farther anteriorly. This was two weeks after the foreign body was swallowed (fig. 1 *C* and *D*).

The following day the patient thought that he felt the foreign body anteriorly and to the left of the thyroid cartilage. When the spot was pointed out to me, I could just barely feel a slight resistance to palpation but nothing definite. The following day the foreign body was pressing the skin outward when the head was extended, and it could be readily seen as well as palpated (fig. 2). With the patient under local anesthesia, the foreign body was extracted through a small incision. The object appeared to be a bristle of a fine steel brush. Roentgenograms taken four days later showed the swelling of the soft tissue to have subsided materially, but there was still thickening in the region of the mouth of the esophagus, which was evidently the site of the entrance of the foreign body. The

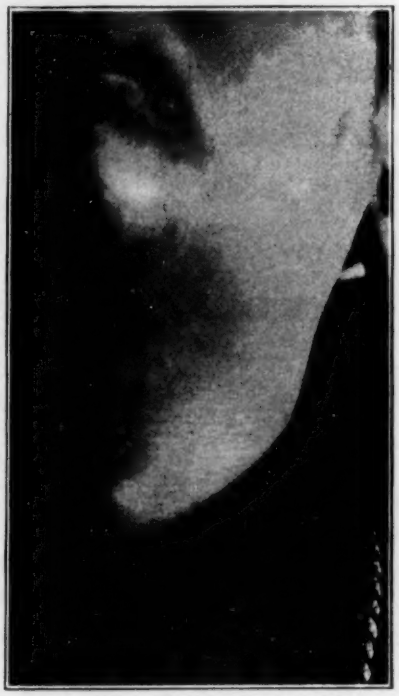

Fig. 2.—The foreign body pushing the skin outward.

temperature continued to go up to 100.5 F., but the patient had no symptoms. He gained 5 pounds (2.3 Kg.) during his stay in the hospital.

Three weeks after the foreign body was ingested, the administration of drugs was stopped. There was no return of any sign of infection, and the boy was discharged. There was no return of his mediastinal swelling.

COMMENT

The outcome in the case justifies the procedures chosen, but it does not signify the anxiety that was experienced in watching the case. When the foreign body started to migrate, it was evident that the vessels of the carotid sheath were near its path and that if it

missed these it might get into the muscle planes and work down into the mediastinum. It is difficult to find a needle in the hand or broken off in a muscle even when it is near the surface and one knows the exact spot of entry. Should it have been necessary to enter the neck to evacuate an accumulation of pus, it would have been by luck only that such a foreign body would have been encountered.

330 Dartmouth Street.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

THE PARANASAL SINUSES

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THE LITERATURE on sinuses to be included in the review for 1945 was much more extensive than that included in reviews during the early days of the war. This is partly due to the arrival of foreign journals previously held up for obvious reasons. The back numbers of *Acta Otolaryngologica,* for instance, arrived en masse, filling the gap as far back as 1941.

Nothing startling has appeared, however, and the pattern follows the general trend of previous years. It is to be noted, nevertheless, that much attention is being paid to general hygienic measures, allergy and conservative therapy. Aerosinusitis received fuller consideration than at any previous time and, from the material presented, seems to be a well established clinical entity.

ANATOMY, PHYSIOLOGY AND PATHOLOGY

De Castro Lima and Villela [1] report the results of their study of thirty skulls on the matter of the sphenoid ostium. They found in most cases that the opening was close to the septum and roof of the nasal cavity. In 44 per cent the ostium was in the upper half of the nasal segment of the anterior wall. In 4 cases it was in the median section of the ethmoid portion of the wall. In four cases the opening was extremely small and placed in the middle of the anterior wall. In 4 other instances the opening was extremely large and occupied almost the entire sphenoid face. The maximum size encountered was 1 cm. by 9 mm. and the smallest 5 by 1 mm. The average was 5 by 3 mm.

In most cases the ostiums were symmetric. The contour varied from irregularly round to elliptic. The latter was the most frequent, the long axis being placed diagonally downward and outward.

The authors agree with previous authors that with care most ostiums can be probed, the chief difficulties being mostly due to deviations of the septum.

1. De Castro Lima, O., and Villela, M. U.: Considerações anatomo-clinicas sôbre o ostio esfenoidal, Rev. med. Bahia **12**:199 (Nov.) 1944.

To determine the effects of penicillin on ciliary activity, Proetz [2] exposed freshly excised tracheal segments of the rabbit to solutions of penicillin of various concentrations, and recorded the results at stated intervals. He found that in concentrations of 250 units per cubic centimeter the ciliary beat persisted up to between twenty-five and twenty-seven hours, which is close to the normal period of survival. Concentrations of 500 units per cubic centimeter reduced ciliary beat to a period of from fifteen to nineteen hours, and concentrations of 5,000 units resulted in loss of ciliary activity within three to six hours. It is evident from this study that solutions of more than 250 units per cubic centimeter are damaging to the ciliated epithelium of the respiratory mucosa.

Colson [3] presents a simple apparatus for demonstrating the action of the inspiratory and expiratory nasal currents on the ventilation of the sinuses. Several typical conditions of constriction at various points in the nose can be duplicated with the apparatus, and the degree of pressure or suction through the collateral opening representing the sinus ostium can be measured with an attached water manometer. This brief presentation is submitted as a corollary to a previous article by the same author, in which the Bernoulli action of air currents is gone into more thoroughly.

Hilding and Essex [4] produced a negative pressure within the frontal sinuses of experimental animals (dogs) by instilling mucinous secretions through a 16 gage needle and measuring the pressure with a water manometer connected up to a second needle of the same caliber. In 4 out of 5 cases the pressure dropped within a few minutes and remained minus for several hours. The authors claim that the negative pressure is due to occlusion of the duct and not to absorption of air, since the same results were obtained by the same experiments in decapitated animals.

Hilding,[5] in further experiments on animals, proves that negative pressure which develops in the sinuses due to blocking of the ostium is not due to absorption of air by the blood vessels, since the results obtained in decapitated animals closely approximated those in the living.

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2. Proetz, A. W.: Cilia and Penicillin, Ann. Otol., Rhin. & Laryng. **54**:94 (March) 1945.

3. Colson, Z. W.: An Experiment Showing the Bernoulli Action in Emptying the Nasal Sinuses, Laryngoscope **55**:587 (Oct.) 1945; Bernoulli's Theorem and Upper Respiratory Drainage, ibid. **55**:444 (Aug.) 1945.

4. Hilding, A. C., and Essex, H. E.: Experimental Production of Negative Pressure in the Frontal Sinus, Proc. Soc. Exper. Biol. & Med. **57**:316 (Dec.) 1944.

5. Hilding, A. C.: Some Further Experiments in the Production of Negative Pressure in the Trachea and the Frontal Sinus by Ciliary Action, Ann. Otol., Rhin. & Laryng. **54**:725 (Dec.) 1945.

He also shows that "the effect of ciliary action upon occluding masses or pistons of mucus within a tube such as a hen's trachea is cumulative."

Fabricant [6] proved the relationship of the p_H of nasal secretions to allergy in the case of a young woman known to be allergic to the odor of gardenias. Experimental exposure to this flower for a period of twenty minutes resulted in a rise of the nasal p_H from 6.5 to 7.9 synchronous with appearance of an allergic reaction.

Brunner, Spiesman and Theobald [7] present 4 cases of pneumosinus dilatans affecting the frontal and ethmoid sinuses and the antrum to various degrees and discuss the pathogenesis of this unusual phenomenon. The condition is characterized by increase in the size of the sinus without alteration of the lining mucosa and with considerable thinning of the bony walls. Acromegaly was found to be the etiologic factor in the cases of this condition in the frontal sinus, a focal osteitis fibrosa of the malar bone was associated with dilatation of the maxillary sinus and trauma seemed to be the etiologic factor in cases of the condition in the ethmoid sinus. It seems that when the condition is bilateral it is due to systemic causes, whereas the unilateral conditions are due to local pathologic changes.

In their conclusions, the authors state that "if the bone alteration begins at a time when the paranasal sinuses are developed, it may narrow the sinuses, provided that the disease is not destructive, but productive, in character. If, however, the bone alteration begins at a time when the sinuses are not yet developed, the result may be an absence or dilatation of the sinus." The article is well illustrated.

Jarvi [8] reports an interesting pathologic finding in a case in which the diseased mucosa removed from an antrum revealed a papillomatous mass, taken from the region of the ostium, which contained cells of an unusual character. These are described as cytoplasmic inclusions with acidophilic central bodies covered by a mucous mantle. The author shows how these mucous mantles grow beyond the cell confine, becoming intercellular and finally reaching the surface. He cites a number of references in the literature to support his contention that this process is the result of a virus infection.

DIAGNOSIS

Parkinson [9] cannot accept p_H determinations based on experiments with an electrode within the nose, as heretofore conducted. His reasons

6. Fabricant, N. D.: Relation of the p_H of Nasal Secretions in Situ to the Activity of the Lysozyme, Arch. Otolaryng. **41**:53 (Jan.) 1945.

7. Brunner, H.; Spiesman, I. G., and Theobald, J. J.: Pneumosinus Dilatans, Ann. Otol., Rhin. & Laryng. **54**:763 (Dec.) 1945.

8. Jarvi, O.: Kieferhohlenpapillom mit (Virusbedingten?) Cytoplasmaeinschlussen, Acta oto-laryng. **32**:284, 1944.

(Footnotes continued on next page)

are that there are two sources of hydrogen ion concentration, namely, the nasal tissues themselves and the secretions present, the two of which come into contact with the electrode and the two of which will yield dissimilar readings. The results of the readings are, in his opinion, misleading, since they do not represent accurately the p_H of either the lining tissue or the nonlining secretions.

Miller,[10] on the basis of a study of cell count of nasal secretions in several hundred cases, draws certain conclusions which he believes are of definite diagnostic and prognostic value. Examinations were made both before and after shrinkage, either glycerin and epinephrine, ichthammol (5 per cent) with epinephrine, equal parts, or displacement with 0.5 per cent ephedrine being used. These procedures were especially useful in obtaining secretion from the frontal, ethmoid and sphenoid sinuses. Since normal nasal secretion contains mostly epithelial cells, with only an occasional lymphocyte, neutrophil or eosinophil, the finding of these cells in any considerable number is a valuable diagnostic aid in determining the presence of chronic infection or allergy. Determinations should be made from both sides of the nose, particularly when infection is suspected, since only one side may be affected. In typical cases of allergy the findings on the two sides are normally identical. These procedures are important in obscure cases in which the usual symptoms of sinusitis are lacking but in which the focus may be low grade, drainage inadequate and the process responsible for such symptoms as headache, migraine, frequent colds, cough and postnasal discharge.

Hernandez[11] discusses the procedures employed in the clinic of Professor Tato for the diagnosis of sinus disease. He mentions the care taken in inspection of the middle meatus for signs of congestion, edema, polyps and secretion. After cocainization, a Killian speculum is used to pry the middle turbinate away from the outer wall, thus exposing the infundibulum to direct inspection. Negative pressure is employed by the autosuction method described by Tato, for the purpose of draining out secretions for bacteriologic examination. Catheterization of the sphenoid sinus and puncture of the antrum are described. A specially curved needle devised by the author is shown in an illustration.

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9. Parkinson, S. N.: Determinations of Intranasal p_H: A Discussion and Criticism, Arch. Otolaryng. **41**:68 (Jan.) 1945.

10. Miller, A. N.: Cytologic Examination of Nasal Smears, Northwest Med. **44**:242 (Aug.) 1945.

11. Hernandez, A.: Exámen semiológico de un enfermo sinusal, Prensa méd. argent. **32**:938 (May 25) 1945.

In two succeeding articles, the same author [12] continues his discussion of diagnostic procedures. He stresses the value of studies with iodized poppyseed oil by displacement in chronic cases and states that when the contrast medium is still present after one hundred to one hundred and twenty hours, if the mucosa is apparently diseased, he believes that operation is indicated.

As for the bacteriologic studies, the author points to the importance of anaerobic streptococci in the causation of bony involvement and mentions the use of zinc peroxide.

The author recognizes the importance of allergy in the production of sinus symptoms and speaks of the vicious circle in which superimposed infection plays a part. It is important to investigate not only the patient's past history but the family history as well. He mentions histamine therapy in the cases of true allergy and also attaches some significance to disturbed hepatic function, which he states may be the cause of incomplete digestion of protein, which in turn may cause allergic phenomena. The various methods of treating chronic sinusitis are taken up seriatim, with emphasis on the use of sulfonamide drugs and penicillin by the de Lima method of autodisplacement. He advises also the intramuscular injection of penicillin in daily doses of 120,000 to 160,000 units. Much space is devoted to a repetition of the details of de Lima's method, previously mentioned and described in this review, but no statistics are presented as to its value beyond the statement that if chronic sinusitis fails to yield after four or five days of intensive treatment locally and intramuscularly with penicillin the case may be considered as indicating operation.

Ibsen [13] concludes from an analysis of ninety-eight examinations with contrast medium in cases of maxillary sinusitis that the appearance and disposition of the oil cannot be relied on for prognostic deductions. However, he does find that when polypi are definitely outlined the subsequent course has proved that such patients are more likely to require radical operation.

Barroilhet [14] finds the antroscope useful in diagnosis. He mentions the instrument made by Pilling and suggests its use in cases in which the roentgenograms and transillumination do not agree. The antrum should not be irrigated prior to antroscopy, because of the air bubbles remaining, which may confuse the observer. He discusses visualization of the ostium, the malar recess and the alveolar recesses. Bleeding and

12. Hernandez, A.: Exámenes radiográficos de los senos, indicaciones, Prensa. méd. argent. **32**:1069 (June 8) 1945; Sinusitis, sintomatología, diagnóstico, tratamiento, ibid. **32**:1211 (June 29) 1945.

13. Ibsen, B.: Sinusitis maxillaris og kontrastundersøgelse, Nord. med. **23**: 1511 (Aug. 18) 1944.

14. Barroilhet, J.: Antroscopy, J. Laryng. & Otol. **59**:231 (June) 1944.

laceration of the mucosa may obscure the picture but are not of frequent occurrence.

The author shows a number of pictures illustrating types of pathologic changes that may be seen.

Kjaer [15] says:

> In 124 cases of maxillary sinusitis the sedimentation reaction under otherwise identical conditions proved to be highest in the acute cases (25 mm. on an average) but otherwise directly proportional to the secretion of pus.
>
> Slight rises (averaging 13 mm.) of the SR [sedimentation rate] were noted in cases of both chronic and clinically latent sinusitis, but some cases in either group showed higher, though moderate, rises of the SR.
>
> Cases of eosinophilic secretion showed a greater tendency to chronicity and recidivation and a correspondingly slightly lower SR than the cases without eosinophilia in the nasal secretion.
>
> The SR was found to be of no prognostic significance beyond that which may attach to the gravity and duration of the pus secretion.

The article by Holvey and Rosenthal [16] on the value of planography in the diagnosis of carcinoma of the antrum is a reprint from that published in *Radiology*.[16a] Several illustrations reveal the tumor mass and destruction of the bony walls of the sinus in the tomographic sections more clearly than in the conventional roentgenograms and, in the authors' opinion, prove the superiority of this procedure. It is of particular value in delineating the extent of the growth in relation to the surrounding areas and thus is extremely helpful in outlining the therapy and forecasting the probable outcome.

SINUSES IN CHILDREN

Taquino [17] reviews the known facts about sinus disease in children and stresses the importance of allergy, although he classifies the disease also as intumescent, catarrhal and purulent. He believes that loss of sense of smell and taste is commoner in children than in adults and more important in diagnosis, since an adult may force himself to eat whereas a child will refuse food when his senses are obtunded. The allergic factor may be suspected when the symptoms of nasal block predominate.

Tonsillectomy in these cases should not be carried out unless the indications are clearcut. This is particularly true in the cases of allergy.

Chemotherapy is also generally contraindicated and should not be relied on when drainage is inadequate. In the main, conservative

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15. Kjaer, M.: Saenkningsreaktionen ved 124 tilfaelde af sinusitis maxillaris, Nord. med. **21**:609 (March 31) 1944; abstracted in English, ibid., p. 611.

16. Holvey, E. H., and Rosenthal, L. M.: La tomografía en la región de los senos maxilares, Rev. radiol. y fisioterap. **12**:118 (Sept.-Oct.) 1945.

16a. Holvey, E. H., and Rosenthal, L. M.: Tomography in the Region of the Maxillary Sinuses, Radiology **42**:458, 1944.

17. Taquino, G. T.: Sinus Disease in Childhood, New Orleans M. & S. J. **98**:8 (July) 1945.

measures are most successful, with attention centered on the constitutional factors.

Bowman [18] finds that sinusitis is a potent etiologic factor in the production of chronic cough in children. The condition is commonest in the winter, and the diagnosis is made by roentgenologic examination, analysis of nasal secretion and the local findings. In addition to the usual conservative measures such as shrinkage, drainage, removal of tonsils and adenoids and general constitutional measures, the author employs roentgenologic therapy, with good results.

The procedure is to give 100 r to the anterior part of the face, repeated in forty-eight hours, with the usual protection to the eyes. The treatment may be repeated in three weeks. This therapy was successful in a series of 25 cases in which other measures had failed.

Dutton and Fuchlow,[19] in treating a large number of asthmatic children, have found that a complicating sinus infection may change the character of the asthmatic attacks in such a manner as to necessitate a different type of therapy. The genuine allergies are characterized by sudden onset, short duration, sudden cessation and complete freedom between attacks. Also, the blood count is normal and sedimentation rate low, and the smears show an abundance of eosinophils. The sinobronchial attacks, however, develop gradually, last longer and are often accompanied with fever and elevated white cell count and sedimentation rate, and the cell count reveals large numbers of neutrophils. The response to vasoconstrictors in these cases is slow, and better results are obtained from local therapy plus antibiotics. Roentgenologic therapy in these cases frequently helps to prolong the periods between attacks.

Wells's [20] contribution follows a common pattern of brief review of the anatomy and pathologic condition of the sinuses. Among the various therapeutic measures mentioned is "diastolization," which the author attributes to Gautier. It consists of a series of various-sized, hollow, rubber bougies, which are "triangularly oval in section and taper towards the distal blind end, which is introduced into the nose." The tube is inflated by means of an attached rubber bulb. The procedure of inflation and deflation is repeated about forty times, with successively larger bougies at intervals. Apparently it is expected that the alternating pressure and relaxation will relieve engorgement and assist drainage.

18. Bowman, J. R.: Sinusitis as Cause of Chronic Cough in Children, J. Tennessee M. A. **38**:215 (July) 1945.

19. Dutton, L. O., and Fuchlow, J. R.: A Note on the Synobronchial Syndrome Complicating Asthma in Children: Its Treatment with X-Ray, M. Rec & Ann. **39**:1197 (Nov.) 1945.

20. Wells, A. G.: The Chronic Running Nose in Children, Practitioner **154**:79 (Feb.) 1945.

Also, the author believes that some good effects may be attributed to action on the sympathetic nervous system. The author states that in a large group of children, 2,191, he found that defective hearing in many cases was associated with chronic nasal conditions and that the diastolization therapy accomplished remarkable improvement in over 57 per cent of the cases; only 18 per cent of the patients failed to respond favorably.

The author believes that, in addition to the usual dietetic, environmental and personal hygiene therapy in prophylaxis, it would be extremely useful to have regular drills in all schools for the purpose of instructing children in proper nasal hygiene. This would consist in demonstration and practice in how to blow the nose and how to breathe properly.

Abegg [21] calls attention to the presence early in infancy of sinus cavities and the possibility of their becoming infected even in the first months of life. He reports a case of the condition occurring in a 5½ month-old infant. During the onset of an acute coryza, edema of the lids appeared on one side, with swelling extending over the cheek. Suction applied to the nose brought considerable amounts of purulent secretion. However, when a spontaneous fistula appeared in the alveolar recess above the lateral incisor and the roentgenograms revealed a cloudy ethmoid sinus with an indistinct bony orbital margin, the patient was operated on. A large orbital abscess was found, leading into a bony erosion of the naso-orbital wall. The improvement was soon manifest in the drop in temperature and lessening of swelling. Yet, after four days another spontaneous fistula appeared in the lower lid, with recurrence of the swelling. The opening was enlarged, releasing a large amount of pus. From that time on, the recovery was uninterrupted. The organism isolated was Pneumococcus type XXVIII.

Russell [22] states that the symptoms which suggest sinus involvement in children are nasal and postnasal discharge, conjunctivitis, iritis, internal squint, dermatitis of the face, pain in the head on coughing, jumping and similar actions, general irritability and instability, fits and obstinate constipation. In some cases the local findings may make the diagnosis easy. In others, one will have to proceed on the aforementioned circumstantial evidence.

The author has had good results from the Proetz displacement procedure, the details of which are carefully set forth. He uses a fine cocaine and ephedrine spray first, which is followed by displacement

21. Abegg, W.: Ueber einen Fall von Siebbeinzellenvereiterung bei einem 5-monatigen Saügling, Ann. pædiat. **161**:233 (Nov.-Dec.) 1943.

22. Russell, H. G. B.: Sinus Trouble in Children, Month. Bull. Min. Health & Emerg. Pub. Health Lab. Serv. **3**:111 (July) 1944.

with a solution of 1 per cent isotonic solution of sodium chloride and 0.5 per cent ephedrine.

Costen [23] states that ethmoiditis in young children is more of a general mechanical blockage of the nasal passages and spaces in the cells than an infection of separate cells or groups of cells. In most cases relief is obtained through shrinking with a mild vasoconstrictor and direct aspiration with a small cannula. General or mass suction is likely to do more harm than good, and the author mentions having seen a death following this procedure in a child. If the antrums are also involved, he advises puncture and irrigation with the patient under general anesthesia. If roentgenograms reveal pulmonary involvement, antrum windows are indicated to provide more prolonged drainage. When the orbit is invaded, the author advises drainage by external incision, with the drain running down into the nose via the middle meatus. Chemotherapy, naturally, has helped limit such conditions and shorten the convalescence.

ORBITAL COMPLICATIONS

Becco's [24] case is unusual in that an orbital abscess resulting from a frontomaxillary infection drained spontaneously from the external corner of the lower lid. The history was somewhat complicated by uncured syphilis and the absence of any clinical symptoms of the sinus infection. Also a previous operation for detached retina resulting in a blind eye added one more confusing item to the picture. Despite operation on the maxillary and frontal sinuses, the exophthalmos and draining fistula persisted until iodized poppyseed oil disclosed an abscess cavity deep in the orbit. This was exposed and drained. A small sequestrum was removed from the posterior part of the upper orbital wall. The author believes that the infection was transmitted from the sinuses by way of preformed vascular channels.

Redslob and Delbos [25] report a case of paresis of the superior oblique muscle due to infection of the sphenoid sinus. The patient gave a history of frequent colds and recurring headaches. Examination was noncontributory, but roentgenograms revealed cloudy maxillary, frontal and sphenoid sinuses. They also showed an infected upper premolar, which had caused periodontitis, with a draining fistula in the gingival recess. Extraction of the tooth and local therapy to the sinuses resulted in cure of the diplopia, which had been present for several days, as well as the long-standing symptoms.

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23. Costen, J. B.: Ethmoiditis in Children, J. Nat. M. A. **37**:94 (May) 1945.

24. Becco, R.: Rara complicación de una sinusitis, Rev. Asoc. méd. argent. **59**:299 (April 15) 1945.

25. Redslob, E., and Delbos, R.: Parésie du grand oblique d'origine sinusienne, Ann. d'ocul. **177**:371, 1941.

Alexander [26] reports 2 cases of children, aged 14 and 11, in whom proptosis developed over a period of a year, due to sinus involvement. In 1 instance a pyocele was found in the frontal and ethmoid cells, and in the other case the ethmoid sinuses were filled with granulation tissue and polypi. The author believes that the condition in the second case would have developed into a mucocele had the sinus not been cleaned out when it was. Both patients were subjected to the Lynch operation, and the results were good. The author discusses various theories as to the pathogenesis of mucocele.

Folk and Brunner [27] discuss the pathways of infection from the sinuses to the orbit, emphasizing the anatomic factors. The orbital septum, which is a fascia-like structure, separates the orbit proper from the lids. Capillaries pass through this septum, thus facilitating the transmission of infection in either direction. Infection of the orbit takes place by reason of erosion of the bony walls of the adjacent sinuses and is facilitated by a thrombophlebitic process involving communicating veins. In infants and children these vessels are unusually numerous and large, which accounts for the frequency of orbital symptoms early in sinus infections at this age. The pathologic findings are discussed further and some diagnostic interpretations based on the localization of the maximum amount of edema.

Folk and Brunner,[28] in another article on the same subject, cite several clinical cases illustrating the points brought out.

INTRACRANIAL COMPLICATIONS

Ebert [29] reports 2 cases of meningitis complicating sinusitis, in both of which the patients recovered. The patient in case 1 was a boy of 15 whose meningeal symptoms appeared about ten days after the onset of a cold in the head. Both antrums contained thick, clumpy pus, and the spinal fluid yielded streptococci. Cultures from the sinuses revealed Streptococcus viridans. Later, cultures from the spinal fluid gave a gram-negative Diplococcus catarrhalis.

The patient in case 2 was a man of 21 who had a cold two weeks prior to onset of meningeal symptoms. Pus was recovered from both maxillary sinuses, yielding staphylococci when grown on ascitic fluid. No bacteria were recovered from the spinal fluid; yet the findings were typically those of purulent meningitis.

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26. Alexander, L. W.: Sinus Disease Producing Monocular Proptosis, New Orleans M. & S. J. **97**:351 (Feb.) 1945.

27. Folk, M. R., and Brunner, H.: Orbital Complications in Paranasal Infections, Eye, Ear, Nose & Throat Monthly **23**:339 (Sept.) 1944.

28. Folk, M. R., and Brunner, H.: Edema of the Eyelids in Infections of the Paranasal Sinuses, Illinois M. J. **87**:245 (May) 1945.

29. Ebert, E.: Acute Nasal Accessory Sinusitis Complicated by Purulent Meningitis: Recovery, Arch. Otolaryng. **41**:48 (Jan.) 1945.

In 1 case small doses of sulfapyridine were given, but they probably played a minor role in the recovery. In the second case no sulfonamide drugs were administered. The only treatment mentioned consisted in frequent irrigations of the maxillary sinuses and nasal cavities proper.

Cacioppo [30] cites a case of death from meningitis and an abscess of the occipital lobe due to pansinusitis in a young diabetic patient. The case is interesting from several angles: first, the prolonged course before fatal outcome (six weeks), undoubtedly due to the inhibiting effect of penicillin and surgical intervention, and, second, the unusual complication, namely, abscess of the occipital lobe, which was attributed to extension by way of the infected meninges. The neurologic findings were confusing, which was natural when the extent of the cranial involvement was considered.

Skillern [31] discusses the pathways of infection from the frontal sinuses to the brain and states that abscess of the brain is usually the result of a blood-borne infection by way of communicating veins. If the infection is transmitted by necrosis of the intervening bone or by way of preformed channels, the resulting abscess is likely to be superficial. In chronic frontal sinusitis he advises intranasal procedures to improve drainage. In acute cases with early osteomyelitis he is in favor of drastic operation, with removal of the anterior wall of the sinus above the superciliary ridge.

Bashir, Taneja and Shah [32] report one of the rare complications of antrum puncture, which occasionally terminates fatally but which in this instance ended favorably. The puncture was followed by introduction of air, on which the patient complained of feeling ill. The cannula was removed and the patient put in the recumbent position. However, she immediately went into generalized clonic convulsions, starting from the left hand and spreading to the entire body. The patient became unconscious and her facies pale. The head deviated to the right, the pupils dilated and the pulse was feeble. The convulsion lasted three minutes, but all four limbs remained rigid for thirty-five minutes. Paresis of the left arm persisted for seventeen hours. Headache and vomiting were present. Treatment given was rest in bed, injections of 0.5 cc. of epinephrine chloride and nikethamide.

The authors conclude that the complication was due to an air embolus and quote Hajek and Lewison on similar cases.

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30. Cacioppo, L. T.: Meningitis and Abscess of the Brain Due to Pansinusitis, Arch. Otolaryng. **42**:47 (July) 1945.

31. Skillern, S. R., Jr.: Frontal Sinus as a Pathway of Infection to the Calvarium and Brain, J. Internat. Coll. Surgeons **8**:308 (July-Aug.) 1945.

32. Bashir, M.; Taneja, G. M., and Shah, M. A.: Cerebral Embolism Following Antrum Puncture, Indian M. Gaz. **80**:140 (March) 1945.

OSTEOMYELITIS

Schnitker and McCarthy [33] report 3 cases of spreading osteomyelitis of the skull following sinus infections in which penicillin proved more successful than sulfonamide drugs in controlling and limiting the infection. In 1 case, however, the patient became penicillin resistant in the later stages and had to be given sulfadiazine for a few days. In 2 of the cases, after the infection was brought under control, the entire diseased frontal bone was removed after the turning down of a flap based on the supraorbital ridges and extending up to the coronal sutures, where the coronal incision was made. Subsequently (about three months later), in the first 2 cases the scalp flap was again dissected off the dura and the bony defect replaced with a tantalum plate (0.015 inch [0.03 cm.] thick) wired to the surrounding bony margins. The authors describe the details in the preparation of the models over which the plates were fashioned.

The authors are impressed with the bacteriostatic properties of penicillin, especially in the staphylococcic infection, but point out that the drug is not bactericidal and that the focus must be eradicated as soon as the local and general conditions are favorable. (It is to be noted that the history in 2 of the cases indicates considerable operation on the sinuses in the subacute stages of a pansinus infection, which may or may not have been a factor in the production of the osteomyelitis.) The illustrations which accompany the article are illuminating.

Guillot [34] reports a case of osteomyelitis of the frontal bone due to the Friedländer bacillus, which was recovered in pure culture from the aspirated pus over the bone. The case was of the subacute type, following a cold with pneumonia and septicemia with phlebitis of the leg. Swelling over the roof of the nose and frontal area appeared about three months after the onset of the illness, and roentgenograms plus the results of the aspiration proved a localized destruction of the bone with abscess formation. The case is a rare one because of the hematogenous origin and the infecting agent.

Gadolin [35] finds objections to the T-shaped supraorbital incision as well as the coronal incision in the surgical treatment of osteomyelitis of the frontal bone. In the former, the frontalis muscle may be permanently disabled, whether through the surgical trauma or as a result of destruction of the superior branches of the facial nerve, thus affecting

33. Schnitker, M. T., and McCarthy, W. D.: Osteomyelitis of the Skull: Its Treatment with Penicillin and Repair of the Defect with Tantalum, Surgery **18**:94 (July) 1945.

34. Guillot, M.: Un cas d'ostéomyélite du frontal à bacille de Friedländer, Bull. et mém. Soc. d. chirurgiens de Paris **32**:90, 1941.

35. Gadolin, H. R.: Ueber die operative Behandlung der Ostitis im Stirnbein, Acta oto-laryng. (supp.) **51**:194, 1944.

the mobility of the forehead in certain phases of facial expression. As for the coronal incision, his objection is that the extensive elevation of the periosteum may interfere with the nutrition of the bone and involves too much manipulation of the soft tissues in an infected area. Finally, it is objectionable in a person who is bald. He offers instead an incision placed just below the eyebrow and carried across the root of the nose, with elevation of the flap upward. He claims that the scar is negligible and the cosmetic results good, and, because of free access to the frontal sinus, intranasal drainage can be effected to such a degree as to permit primary closure of the incision. He states, however, that this technic is applicable only in cases of less serious conditions, in which the disease is not too widespread and the general reaction satisfactory. Three cases are cited.

Hernandez [36] discusses osteomyelitis of the frontal bone in general terms and brings out several important points that cannot be stressed too often. He recognizes the importance of the anaerobic streptococcus as a frequent invader in these cases and the necessity of combating it by free exposure and the local use of zinc peroxide. The author does not believe that the sulfonamide drugs are of much value but is committed to the use of penicillin in large doses. Also he advises the employment of heparin as a means of retarding the thrombophlebitic process. The various pathways by which the infection spreads are discussed together with the implications.

Thomasen's [37] patient was a girl of 16, and the condition came on six weeks after an abscess of the septum had been incised. The osteomyelitis involved the left half of the frontal bone and extended to the parietal and squamous bones. Most of the diseased bone was removed via a coronal incision (Mygind), but several subsequent revisions were necessary. Roentgenologic studies three years later revealed considerable formation of new bone, but an area measuring 4 by 4 cm. was still open. The patient was completely recovered and feeling well.

Osteomyelitis of the superior maxilla is not so common in adults. Hirst [38] reports a case in some detail. The patient suffered recurring attacks of purulent maxillary sinusitis over a period of ten years. In addition to a purosanguineous discharge, there were local tenderness and roentgenologic findings indicating a thickened membrane and involvement of the bony walls. A Caldwell-Luc operation confirmed the diagnosis. Despite sulfonamide therapy there was evidence that the

36. Hernandez, A.: Osteomielitis del frontal, Prensa méd. argent **32**:1488 (Aug. 3) 1945.

37. Thomasen, F.: A Case of Cranial Osteomyelitis, Acta oto-laryng. **30**:524, 1942.

38. Hirst, O. C.: Osteomyelitis of the Superior Maxilla: Treatment with Penicillin, Arch. Otolaryng. **41**:351 (May) 1945.

bony process was extending, as indicated by swelling of the lids and swelling and tenderness of the hard palate, superior maxilla and malar bones. A sequestrum was removed from the alveolus shortly after extraction of several carious teeth. Penicillin was employed locally and intramuscularly for several days, when the local symptoms promptly subsided. Hemolytic Staphylococcus aureus and Str. viridans and Neisseria catarrhalis were recovered from the secretions.

Greenwood [39] quotes Wilensky [40] to the effect that osteomyelitis of the superior maxilla in infants is hematogenous in origin and not due to maxillary sinusitis, as believed by many. Embarrassment of the circulation in the closed arterial plexus of the alveolus results in sequestration, which leads to loss of tooth buds. Secondary infection may later involve the sinus. Trauma is considered a factor and may more frequently follow minor intranasal procedures than the more radical external operations, probably due to activity of anaerobes, as pointed out by Galloway.[41]

The author states that therapy is conservative until sequestration has taken place.

MALIGNANT TUMORS

Orsi [42] discusses the subject of malignant tumors in and about the antrum at great length. He gives all the details of the anatomy of the sinus in relation to adjacent structures and then takes up the point of origin of the growth, mentioning the oral, alveolar and nasal structures in addition to the sinus itself, and discusses the implications in the development of each type. As to pathogenesis, the author mentions chronic infections, trauma and degeneration of benign growths as predisposing factors. Nothing new is added so far as symptomatology is concerned. The author attempts to analyze the early signs which may be observed in some cases and which depend on the original site of the growth, and he emphasizes the value of good roentgenograms as well as antroscopy.

The surgical treatment recommended is a radical procedure involving extensive external incision similar to the old Moure technic and removal of practically the entire superior maxilla. Radiotherapy is mentioned both as a postoperative procedure and as a direct curative agent. Three cases are cited, with good results over a two to three year period.

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39. Greenwood, G. J.: Acute Pyogenic Osteomyelitis of the Facial Bones, Illinois M. J. **87**:302 (June) 1945.

40. Wilensky, A. O.: Osteomyelitis, New York, The Macmillan Company, 1934.

41. Galloway, T. C.: Infections with Anaerobic Streptococci with Special Reference to Cranial Osteomyelitis, Tr. Am. Laryng. A. **64**:35, 1942.

42. Orsi, J. L.: Tumores malignos del maxilar superior y del seno maxilar, Rev. méd. de Rosario **34**:983 (Oct.) 1944.

While mention is made of Olmgren's and New's statistics, it is interesting to note that the use of surgical diathermy is barely touched on.

Snitman [43] calls attention to the frequent inoperability of carcinoma of the antrum because of late diagnosis and unfavorable location of the lesion. He suggests that in such cases good results may be obtained through a combination of surgical exposure, external irradiation and local applications of radium within the cavity.

The management of metastatic involvement of the lymph nodes follows the plan attributed to the Memorial Hospital of New York. If the primary lesion is controllable and the nodes are free, dissection of the neck is performed. If the nodes are inoperable, they are treated by external irradiation and intramural implantation of radon seeds.

Berger [44] reports an unusual case in which the two maxillary sinuses were involved in malignant growths independently of each other and at different times. The histologic diagnosis was papillary carcinoma grade IV on the right side and carcinoma on the left. The tumor of the right antrum was discovered first, following intractable epistaxis, which was traced to a lesion in the middle meatus. Subsequent roentgenograms revealed striking involvement of the whole antrum, and a Caldwell-Luc exposure afforded sufficient approach to eradicate the mass, which had already eroded the posterior bony wall, part of the floor and most of the mesial wall.

Postoperative follow-up included roentgenograms which revealed a mass growing from the external wall of the left antrum into the sinus, which in a period of six months attained sufficient size to render the sinus completely opaque. Operation revealed that the mass had eroded the anterior wall of the sinus and portions of the other walls. Both sides received postoperative irradiation therapy and were clinically well for a period not definitely mentioned. The author states that he has been unable to find a similar case in the literature.

Strickland [45] presents some interesting illustrations revealing the process of fabricating a removable prosthesis in a case of recurring adamantinoma of the superior maxilla in a young man, which necessitated removal of the major portion of the bone, including the alveolar and palatal processes. The patient was first operated on in 1942 and again two years later, at which time the exenteration was accomplished through a modified Moure incision.

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43. Snitman, M. F.: Individualization in the Management of Carcinoma of the Maxillary Sinus, Ann. Otol., Rhin. & Laryng. **54**:125 (March) 1945.

44. Berger, M. D.: Neoplasms of Both Maxillary Sinuses, Arch. Otolaryng. **42**:397 (Nov.-Dec.) 1945.

45. Strickland, J. M.: Prosthetic Restoration with a Removable Partial Denture After Surgical Removal of a Tumor of the Right Maxillary Antrum, Am. J. Orthodontics (Oral Surg. Sect.) **31**:504 (Aug.) 1945.

Ponthus, Dargent and Papillon [46] describe a case of epidermoid carcinoma of the upper jaw which was cured by roentgen therapy. The lesion was extensive enough to cause swelling of the face, buccal fold and palate; yet, after its recession under this therapy, a resection of the jaw was performed and revealed no trace of the carcinoma.

Schwartz's [47] patient was a woman of 42 who complained of frontal headaches for a period of four years. Roentgenograms demonstrated Paget's disease of the skull, but no defect could be shown. However, there developed recently a swelling in the left postfrontal area which was firm and slightly tender. The roentgenogram which is shown reveals a large, well defined defect in the bone. The differential diagnosis between sarcoma, epidermoid and myeloma was discussed prior to the biopsy, which revealed a typical giant cell myeloma.

The photomicrograph shows "large numbers of multinucleated cells supported by a stroma of spindle and oval shaped connective tissue cells which are lying in a small amount of collagen fibril." The lesion was treated by radiotherapy. Two series of treatment, totaling 1,274 and 1,554 r, were given during the course of a month. After the lapse of a year, new bone could be demonstrated filling in the defect. The bone seemed to be typically that of osteitis deformans.

Formby [48] removed a tumor from the ethmoid region in a youth of 18, which was pronounced malignant. The microscopic report was "group of closely packed cells with small spherical nuclei and little cytoplasm. The groups are separated by a fibrous stroma. Mitoses are few. In some parts of the section there was definite evidence of infiltration and the growth is histologically malignant." The mass was first noticed near the internal canthus and was suspected of being connected with the lacrimal sac. However, it was found to extend into the nose, presenting a mulberry-like tumor in the middle meatus. It was removed through an external approach and was easily shelled out, apparently not being of the infiltrating type. The patient was well and free from disease when seen three months later but was to be kept under observation.

Lionel Colledge, discussing the presentation, thought the tumor was probably a basal cell carcinoma.

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46. Ponthus, P.; Dargent, M., and Papillon, J.: Sur les possibilités de la rœntgenthérapie dans le cancer du sinus maxillaire, J. de radiol. et d'électrol. **26**:73, 1944-1945.

47. Schwartz, C. W.: Solitary Myeloma of the Frontal Bone, Am. J. Roentgenol. **53**:573 (June) 1945.

48. Formby, M. L.: Tumor of the Left Ethmoid, Proc. Roy. Soc. Med. **38**:620 (Sept.) 1945.

NONMALIGNANT TUMORS

Dowling [49] reports 5 cases of osteoma of the frontal sinus, in 3 of which the patients were operated on. He suggests a horizontal incision above the brows as affording a better approach to both sinuses and claims that the cosmetic results are excellent.

The author comments on the rarity of this tumor judging by the reports in the literature. He raises the question as to whether the tumor may not be commoner in Europe, since 2 of the 3 patients operated on were German prisoners of war.

Duclos and Corcuera [50] report a case of osteoma in a girl aged 18, which seemed to originate near the junction of the frontal process of the maxilla with the lacrimal bone and occupied most of the ethmoid mass. It eroded the lamina papyracea, invading the orbit and causing exophthalmos. Also a good portion of the frontal sinus was involved. It was removed through an external incision. The mass weighed 30 Gm. and was found to consist of layers of well developed bone containing irregular medullary spaces.

Von Kassay [51] reports a case of osteoma of the orbit in the frontal region which did not involve the frontal sinus. The roentgenogram shows a dense shadow extending from the sphenoid sinus forward to the supraorbital margin along the roof of the orbit. It was removed, without causing a deformity, by an osteoplastic procedure, in which the lateral portion of the infraorbital margin was turned back, without opening of the frontal sinus, to afford easy access to the tumor. This was removed en masse, together with the medial portion of the pars orbitalis of the frontal bone and adjacent part of the sphenoid. The exposed dura was found intact. The mass measured 4.3 by 3.2 cm. and consisted of dense ivory-like bone.

The condition is unusual in the following respects: (1) size and location, (2) freedom from involvement of the frontal sinus despite the extent of the growth and (3) operative procedure which avoided deformity.

Secretan [52] presents 3 cases of fibrocystic osteitis of the ethmoid sinus, with some excellent histologic slides. They show a network of osteofibrotic character which varies considerably in the 3 instances. Some of the slides resemble typical Recklinghausen disease, others look

49. Dowling, J. R.: Osteoma of the Frontal Sinus, Arch. Otolaryng. **41**:99 (Feb.) 1945.

50. Duclos, J., and Corcuera, J.: Meningitis otógena a neumococo, Rev. otorrinolaring. **5**:152 (Sept.) 1945.

51. Von Kassay, D.: Ein operierter Fall von Osteoma orbitale, Acta oto-laryng. **29**:348, 1941.

52. Secretan, J. P.: A propos d'ostéite fibrokystique localisée à l'ethmoide, Acta oto-laryng. **29**:360, 1941.

like Paget's disease and still others look like a fibrous epilus. In 1 case the tissue is arranged in concentric layers. The author recalls the fact that in four well known works on the subject the condition is differently named by the various authors. For instance, Trauner speaks of hyperostosis, Marx of leontiasis ossea, Benjamin of osteofibrosis with atypical calcification and Hellner of a localized osteitis fibrosis of traumatic origin. The author agrees with Hellner from the point of view of diagnosis and classification but has his doubts about the certainty of its being post-traumatic. He feels that one is here dealing with a granuloma which may well be the result of trauma but could also be caused by hemorrhage through stasis or by an inflammatory process.

Woodruff [53] reports a case of a fibroma involving the ethmoid and frontal sinuses in a boy of 13, which was removed by way of a Jansen-Lynch procedure. The original pathologic diagnosis was "fibro-osteosarcoma," which was later revised into an "ossifying fibroma" after inspection by several pathologists, including Colonel Ash. The author believes with Ewing that the origin of the growth may be attributed to the irritation of a chronic infection in the ethmoid sinus rather than to a misplaced island of tissue, although the latter cannot be positively excluded. Metaplasia of the fibrous tissue into bone is not an uncommon finding.

Rosedale [54] presents 2 cases of massive fibromas of the antrum occurring in a brother and sister, both of whom were suffering from multiple neurofibromas (von Recklinghausen's disease). The mass was excised in the 1 case, with a good result, but consent to operation in the second case was withheld. The illustrations and histories of the cases are given in detail.

Steinmann [55] reports 4 cases of cylindroma involving the ethmoid region which were observed at the Univerisity of Zurich between 1937 and 1943. There were 3 women and 1 man, and the ages ranged from 45 to 73. He found the course of the disease benign, only 1 patient having a metastasis, although they all showed a tendency to local recurrences. All of them survived for periods of one and a half to six years and were in good health at the time the report was issued. They all showed a tendency to slow growth of an expansive nature, without evidence of true infiltration. They were treated by radical operation and postoperative irradiation. Apparently the latter had little influence in preventing recurrence. Despite the benign character of the tumor,

53. Woodruff, G. H.: Ossifying Fibroma of the Ethmoid Cells and the Frontal Sinus, Ann. Otol., Rhin. & Laryng. **54**:582 (Sept.) 1945.

54. Rosedale, R. S.: Massive Fibroma of the Maxillary Antrum as a Part of Multiple Neurofibromatosis in Siblings, Arch. Otolaryng. **42**:208 (Sept.) 1945.

55. Steinmann, E. P.: Zur Klinik der Cylindrome im Bereiche der Nase, Pract. oto-rhino-laryng. **6**:71, 1944.

early diagnosis and operation are important because of the extensive size the growth may attain, whereby neighboring organs are endangered through sheer pressure. The histologic structure is characteristic and should not be missed even in early biopsies. Several typical slides are pictured.

Medan [56] describes a case of ethmofrontal mucocele in a man of 57, which had been present since the age of 15. At that time the appearance of a swelling on the forehead, between the eyes, led to a simple incision and drainage. The relief was temporary, and over a period of years there were recurrences until the mass began to cause exophthalmos and displacement of the bulb with diplopia. Roentgenograms revealed an extensive dilatation of the frontal sinus, with obliteration of the ethmoid sinuses and absorption of the bony orbital walls. The author chose to evacuate the mass intranasally, and, after several procedures which were necessary to maintain the passageway into the cavity, a permanent opening was established, with relief of the symptoms. The author discusses the pathogenesis, symptomatology and complications of mucoceles, with liberal citations from the literature. As for treatment, he believes that all such conditions complicated by suppuration in the sinuses should be operated on through the external route. In cases without complications, particularly if the cavity is single and confined mostly to the ethmoid area, he favors the intranasal route, although he is aware of the difficulties in the approach and maintenance of an adequate passage. Multilocular cysts and those involving a large frontal sinus with deep recesses had better be operated on through the external route.

Frostberg [57] discusses the roentgenologic aspects in the diagnosis of mucocele, pyocele and cholesteatoma of the frontal sinus, citing 8 cases. The characteristic findings are increased translucency and thinning of the bony walls, with expansion and erosion. There is nothing in the roentgenograms that is characteristic in differentiating these three conditions prior to operation. The author prefers the hyperextended axial projection in addition to the usual anteroposterior and lateral views, because it clearly reveals encroachment on the anterior cranial fossa through expansion of the posterior plate of the sinus. The roentgenograms which accompany the article are unusually clear.

Wilkerson [58] presents an extensive survey of the entire subject of mucocele, covering the history, pathogenesis, therapy and other phases.

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56. Medan, L. S.: Mucocele etmoidofrontal, Med. clín., Barcelona **2**:56 (Jan.) 1944.

57. Frostberg, N.: Das Röntgenbild bei Muco-Pyocele und Cholesteatom im Sinus frontalis, Acta radiol. **25**:493, 1944.

58. Wilkerson, W. W., Jr.: Mucocele of the Nasal Accessory Sinuses, Laryngoscope **55**:295 (June) 1945.

The condition in the case he presents involved the frontal sinus, and there was a history of a spontaneous discharge of some magnitude several months before the onset of pronounced ocular symptoms. He attributes the loss of vision to circulatory disturbances due to pressure. A Lynch operation was done, which revealed thickening of the mucosa in the region of the nasofrontal duct and erosion of the posterior plate, with necrosis of a limited area of the dura. The dura was found firmly attached to the brain in the surrounding area, which doubtless accounts for the prevention of an intracranial spreading infection. External drainage was effected for a period of fifty-one days, and the patient recovered completely.

The author believes that in this case at least the mucocele resulted from occlusion of the duct by an infection, causing thickening of the mucous membrane in that region.

Sadowsky [59] reports a case of mucocele of the frontal sinus in a woman of 20, with erosion of the floor of the sinus. Diagnostic puncture revealed a thin mucoid fluid containing the larvae of a fly (Muscidae) and a few macerated cells. Iodized poppyseed oil was instilled, and roentgenograms showed an extensive cavity. At operation the nasofrontal duct was found completely blocked. Permanent drainage into the nose was effected by exenteration of the ethmoid cells and resection of the head of the turbinal. When seen eighteen months later, the passage was still 1.5 cm. in diameter.

SURGICAL TREATMENT OF THE SINUSES

For anesthesia in radical operation on the antrum, Muller [60] recommends blocking the sphenopalatine ganglion via the epizygomatic route. A 2 per cent procaine hydrochloride solution with epinephrine being used, the needle is introduced just behind the posterior border of the frontal process of the malar bone for a distance of 4 to 5 cm., depending on the width of the skull, which is determined by the bitemporal and bimalar measurements. From this angle there is no danger of entering the inferior orbital fissure since the upper border overhangs and protects the lower border.

Rodel [61] cites numerous authors on the subject of dental disturbances resulting from operations on the antrum. Most of the evidence seems

59. Sadowsky, N.: Mucocele of the Frontal Sinus, Acta oto-laryng. orient. **1**:21, 1945.

60. Muller, F.: Da aplicação da anestesia regional epizigomática no nervo maxilar superior, na operação radical do seio maxilar, Rev. med. e cir. de São Paulo **3**:195 (May-June) 1943.

to indicate loss of sensitivity in the teeth, resulting from removal of the bony anterior wall and antrum mucosa, without accompanying loss of vitality. As long as the apexes of the teeth are not traumatized and the vascular plexus of the alveolus is undisturbed, the pulp will survive despite loss of sensation. Yet even this is disputed by some authors who claim that loss of trophic nerve fibers will lead to shrinkage of the pulp, which predisposes the tooth to caries. The author feels that the criteria adopted by some authors is unsatisfactory, because many patients are frightened by the electric currents employed and their reactions cannot be relied on. He believes that the use of thermal agents for testing sensitivity is more accurate and more agreeable. His conclusions are to follow in a subsequent issue of the journal.

McQuiston [62] shows a simple procedure by which an antrum fistula in the alveolus may be closed. It consists of two sliding flaps on the buccal and palatine sides of the alveolus opposite the fistula. These are brought together over the opening, which has been prepared by thorough curetting and freshening of the margins. The denuded areas from which the flaps have been pushed downward are left to heal over by granulation. The illustrations accompanying the article are clear and comprehensive.

Hernandez [63] discusses the relative merits of the Claoué, Halle and Caldwell-Luc operations, without any particular stress on any of them. The technical details are enumerated, but nothing new is added by the way of critique.

Bedford Russell [64] feels that there is a tendency among rhinologists to temporize in cases of frontal sinusitis until the infundibular region becomes "thoroughly soaked in streptococcal juices, and the bone has been somewhat thickened by the previous operative work in the neighbourhood." He claims that when finally these conditions come to the exenteration stage the success of the operation is "prejudiced by the deterioration in local and general health which has inevitably occurred." He therefore advises earlier diagnosis and open operation as a first step rather than as an "appendix to multiple palliative operations."

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61. Rodel, A.: Zur Frage der Zahnschäden nach Kieferhöhlenoperationen, Pract. oto-rhino-laryng. **6**:57, 1944.

62. McQuiston, R. J.: Maxillary Sinusitis of Dental Origin and the Management of Antral Fistula, Ann. Otol., Rhin. & Laryng. **54**:373 (June) 1945.

63. Hernandez, A.: Operaciones de Claoué, Halle, Caldwell-Luc, Prensa méd. argent. **32**:1370 (July 20) 1945.

64. Russell, H. G. B.: Causes of Failure in the Surgical Treatment of Chronic Frontal Sinusitis, Proc. Roy. Soc. Med. **38**:291 (April) 1945; in discussion on Causes of Failure in the Surgical Treatment of Chronic Frontal Sinusitis, J. Laryng. & Otol. **60**:31 (Jan.) 1945.

The author feels that many cases follow in the wake of the exanthemas, when careful examination will reveal evidence of sinus involvement. Absence of pus is no criterion, since the streptococcus is more likely to cause an edema of the tissues rather than a fluid exudate. Cultures taken from the deeper layers of biopsy specimens of the mucosa reveal a copious growth of pathogenic organisms. Also, the author insists on the importance of culturing for the anaerobes which are the common cause of osteomyelitis. While the condition in early stages is catarrhal in nature and amenable to therapy, it is important to recognize failure of the tissues in some cases to return to normal and to institute surgical treatment.

Failure of operation is due in many cases to inadequate exposure and insufficient excision of diseased tissue. He advises a median incision when involvement of both sides is suspected and is not deterred by possible cosmetic defects, especially since plastic procedures are available and yield such good results. He aims at total obliteration of the sinus and prevents the ingrowth of nasal epithelium by invaginating the infundibular mucosa into the nose. Skin grafting, as advised by Ferris Smith, was tried in several cases, with unsuccessful results, ending in proliferation of the epithelium with exfoliation, necessitating secondary operation.

In the discussion that followed Dr. Russell's presentation, Howarth again called attention to the ethmoid sinus as the key to the frontal sinus and the importance of cleaning out these cells when the frontal sinus is being operated on. He likes Mosher's approach and cautions against rasping the bony ring guarding the sinus. If external operation is indicated he advises a wide exposure, enlarging the duct to the maximum and employing a skin graft. In his opinion the obliteration procedure is but rarely indicated. Patterson repeated some of the things previously incorporated in his articles on this subject, including the technic he advocates (abstracted in this review for 1943).

Negus could not agree with Russell on the point of early eradication of the sinus. In many cases it is extremely difficult to obliterate the sinus. In most cases he feels that intranasal measures will be successful if properly applied and, in his experience, will not interfere with a subsequent external operation should that be indicated. He did not favor the midline incision. Also, while he advocates thorough exenteration of the ethmoid sinuses, he does not see the necessity of removing more of the ciliated epithelium than is necessary. He has had good results from a skin graft around a tube and packing left in situ for ten days. A comparison of his results in a group of cases prior to 1932, when the graft was not used, showed a much smaller proportion of successful results than in the cases in which grafts were

used. Only 10 out of 31 patients in the early cases were cured, whereas out of 75 of the later group, 20 of whom had been previously operated on with unsuccessful results, 56 yielded good results.

Woodman stated that chronic sinusitis could often be prevented by a direct opening of the sinus in the acute stage for drainage. As for the skin graft, he had found the procedure difficult and unreliable.

Kepes [65] claims that failure of the Killian operation on the frontal sinus is in many cases due to the dead space remaining at the medial end of the cavity, which leads to reinfection and recurrences. To prevent this condition he suggests removal of the inner third of the bony shelf and keeping this portion of the wound open by repeated packs until it fills in with granulation tissue. The resulting deformity is slight and can be filled in later with a fat implant.

García Alvarez [66] claims that in many cases of chronic frontal sinusitis it is impossible to drain adequately the cavity intranasally because of a deviated septum, polypoid ethmoid sinuses and tortuous nasofrontal duct. In such cases, if the roentgenograms reveal chronic pathologic conditions, he advises an external operation and mentions the Ogston-Luc procedure, which he employed in the 1 case he cites.

Goodale [67] employed tantalum foil (0.00025 inch [0.0006 cm.] thick) to supplant the orbital ridge removed in radical operation on the frontal sinus, thus preventing collapse of the nasofrontal passage and insuring permanent airway to the cavity after operation. A strip of the metal 1.5 cm. wide and 4 cm. long was sutured to the orbital periosteum near the pulley, extending medially and downward into the upper part of the nasal fossa. The suture material used was tantalum wire of 0.003 inch (0.07 cm.) thickness. The author reports 8 cases of operation with successful results by this method. The patients experienced no discomfort from the foreign body, and the nasofrontal passage remained open, with little scar tissue.

Patterson [68] again describes an external approach for eradicating disease of the ethmoid and sphenoid sinuses and the antrum, essentially the same as in a previous communication abstracted in the review of "The Paranasal Sinuses" for 1944. He reports 73 cases of patients operated on by himself, Dr. Hargrove and Dr. Harris from 1939 to 1945, with the following results: diplopia (3 cases) and transient epiphora, which,

65. Kepes, P.: Modifikation der Killian'schen radikalen Stirnhohlenoperation, Acta oto-laryng. **30**:110, 1942.

66. García Alvarez, J.: La sinusitis frontal crónica y su tratamiento quirurgico, Rev. Policlín. Caracas **14**:39 (Jan.-Feb.) 1945.

67. Goodale, R. L.: The Use of Tantalum in Radical Frontal Sinus Surgery, Ann. Otol., Rhin. & Laryng. **54**:757 (Dec.) 1945.

68. Patterson, N.: External Operation on the Nasal Sinuses, Proc. Roy. Soc. Med. **38**:622 (Sept.) 1945.

however, was less frequent, as greater care was exercised later in avoiding trauma to the nasolacrimal duct. There were no other complications. The average stay in the hospital in cases in which operation was done with the patient under local anesthesia was seven days; when done with the patient under general anesthesia it was eleven days. In 3 cases polypi recurred, necessitating further operation.

NONSURGICAL THERAPY (GENERAL)

Van Alyea [69] believes that the recent trend to conservatism in sinus therapy may be attributed to advancement of our knowledge of nasal physiology and improved methods of treatment as well as to frequent failure of radical operation. He emphasizes the importance of adequate drainage and ventilation, which may be accomplished by resection of the nasal septum, enlarging the ostiums of the sphenoid and frontal sinuses and antrostomy via the inferior meatus in cases in which the natural opening is inadequate. Displacement therapy for the ethmoid sinuses and proper attention to constitutional factors also are important.

Again, Van Alyea [70] is strongly against radical operation in chronic sinus disease except in rare instances. He cites a number of cases in which examination of the excised tissues revealed intact surface epithelium and a predominance of eosinophils in a definitely edematous stroma. Furthermore, the operation in these cases failed to relieve the patients of their symptoms. He points out the importance of evaluating the allergic factor which is at the bottom of so many of these chronic cases and of applying measures that will facilitate free ventilation and drainage. This can be accomplished in most cases by submucous resection of the septum, infraction of the middle turbinate and removal of overhanging cells which obstruct the middle meatus. Irrigation of the sphenoid sinus, displacement therapy for the ethmoid sinuses and attention to dental factors in antrum disease are all important therapeutic aids. Also, he feels that in cases in which operation is indicated in antrum disease the intranasal antrostomy operation will accomplish the desired purpose.

Along the same lines, Griffiths [71] mentions the various procedures which facilitate ventilation and drainage and emphasizes the importance of general care, such as proper diet, rest, fresh air and short wave therapy.

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69. Van Alyea, O. E.: Modern Trends in Sinus Therapy, Eye, Ear, Nose & Throat Monthly **24**:125 (March) 1945.

70. Van Alyea, O. E.: Management of Chronic Sinus Disease, Ann. Otol., Rhin. & Laryng. **55**:443 (Sept.) 1945.

71. Griffiths, J. I.: Treatment of Chronic Sinusitis, M. Press **214**:102 (Aug. 15) 1945.

Proetz [72] suggests a displacement procedure for the introduction of vasoconstrictor gases into the sinuses in cases in which the use of fluids might possibly tend to spread infection to the unaffected sinuses. It may be carried out with the patient in the normal upright position. Intermittent suction is applied to one nostril, while the opposite nostril is occluded by the usual bomb-shaped cylinder containing the cotton plug saturated with the volatile drug. It is important that the hole in the container be somewhat larger at the end which is inserted in the nostril than at the opposite, or free, end, or else adequate negative pressure cannot be attained. Proetz suggests that the hole in the distal end be not larger than 1/64 inch (0.03 cm.).

Van Alyea [73] presents a number of illustrations of sections showing the various types of maxillary ostiums and accessory openings. He enters a strong plea for a more universal adoption of irrigation via the middle meatus. Even in cases in which these openings cannot be located, it is preferable to perforate the thin membranous partition in this location rather than to puncture through the inferior meatus. It is all a matter of practice in familiarizing oneself with the locale and the feel of the catheter as it probes for the openings. Certainly, from the patient's point of view, the procedure is far less distressing than a puncture below the inferior turbinate. The technic is described fully.

DRUGS

Fabricant [74] feels that the abuse of nose drops in more widespread than generally believed and suggests methods of curbing it. This refers particularly to the indiscriminate use of nose drops in infants, for whom the dosage is frequently uncontrolled and excessive. He claims that adequate results may be obtained by using cotton-wrapped applicators dipped into the desired medicament and inserted within the nares of the child. Furthermore, he advocates the use of a graduated dropper or one which will deliver only the limited amount desired in the particular case. Such an automatic dropper has as yet not been perfected.

Kully [75] calls attention to pernicious effects of prolonged self medication with vasoconstrictor nose drops. Secondary vasodilation and irritation due to the added antiseptics may give rise to a typical vasomotor syndrome, often indistinguishable from a true allergy. Acute

72. Proetz A. W.: An Adaptation of the Displacement Principle for the Introduction of Gases into the Sinuses, Ann. Otol., Rhin. & Laryng. **54**:91 (March) 1945.

73. Van Alyea, O. E.: Irrigation of the Maxillary Sinus by Way of the Middle Meatus, Ann. Otol., Rhin. & Laryng. **54**:298 (June) 1945.

74. Fabricant, N. D.: On Correcting the Abuse of Nose-Drops, Eye, Ear, Nose & Throat Monthly **24**:515 (Nov.) 1945.

75. Kully, B. M.: The Use and Abuse of Nasal Vasoconstrictor Medications, J. A. M. A. **127**:307 (Feb. 10) 1945.

rhinitis is often prolonged by the excessive use of nose drops, and at times otitic complications may be due to the edematous state of the nasal and nasopharyngeal mucosa, caused by the overuse of the vasoconstrictor solutions.

Hagens, Karp and Farmer [76] describe an apparatus by means of which it is possible to deliver a penicillin mist into the nasal passages for local therapy. This is inhaled by the patient hourly for five minutes during the day and twice at night. The oxygen flow is regulated to nebulize 1.5 cc. (12,000 units) of the penicillin solution. It was tried out in a series of 22 patients suffering from bronchiectasis, asthma, bronchitis, antritis, atypical pneumonia and similar conditions. Examinations of sputum taken before and after treatment revealed a definite reduction in the bacterial flora, affecting particularly the gram-positive organisms. The patients with bronchiectasis showed temporary improvement but relapsed when the treatment was discontinued. Acute pulmonary conditions in children responded favorably, which suggests that it might be profitably employed in cases in which intravenous or intramuscular therapy is contraindicated or not feasible.

Priest [77] treated 8 patients with chronic maxillary sinusitis by irrigations with penicillin (8,000 units every three hours) and obtained a cure in only 2, in both of whom the condition was associated with bronchiectasis. Two other patients in whom the process was subacute also recovered. In 2 patients, the chronic frontal sinusitis similarly treated failed to yield.

Treatment was carried out by irrigation through indwelling ureteral catheters passed through an antrum trocar. The author concludes that this form of therapy is not indicated in chronic cases but may be of value in the subacute stage.

Tremble and Smith [78] employed a solution of penicillin in isotonic solution of sodium chloride, 10,000 units per cubic centimeter, by displacement in the treatment of several patients with chronic sinusitis, with encouraging results. Preliminary cultures taken from the middle meatuses establish the identity of the offending organisms. Naturally, the best results are obtained in cases in which gram-positive organisms predominate. The authors use a 5 to 8 per cent cocaine solution preliminary to the treatment, despite which the patients frequently complain of pain and burning. To combat these disturbing symptoms they advocate dissolving the penicillin in a 1 per cent solution of tetracaine

76. Hagens, E. W.; Karp, M., and Farmer, C. J.: Inhalation Method for Penicillin Therapy, Arch. Otolaryng. **41**:333 (May) 1945.

77. Priest, R. E.: Treatment of Suppurative Paranasal Sinusitis with Repeated Irrigations of Penicillin, Ann. Otol., Rhin. & Laryng. **54**:786 (Dec.) 1945.

78. Tremble, G. E., and Smith, F.: Nasal Medication in Sinusitis, Canad. M. A. J. **53**:564 (Dec.) 1945.

hydrochloride, which they found to have a definite mitigating effect. One case is given in detail, concerning a man of 61 who suffered attacks of severe spasmodic cough. This was traced to a chronic sinusitis due to Staph. aureus, and relief was obtained after a number of instillations under displacement. Bacteriologic examinations during the course of the treatment demonstrated a steady reduction in the number of bacteria until they were apparently entirely eliminated.

Hansen and Work [79] report encouraging results from the use of penicillin in a series of 46 cases of sinusitis of various degrees. Eleven patients with maxillary sinusitis were treated by irrigation and the remaining 35 by intramuscular injection. The most gratifying results were obtained in the severe conditions, such as infection complicating extensive trauma, osteomyelitis, orbital cellulitis and conditions following radical operation on the sinuses. The drug was not used in cases of acute sinusitis without complications.

Although good results were observed from the instillation of penicillin solutions into the antrums in a few subacute and early chronic cases, the authors would draw no conclusions, in view of the fact that similar results have been obtained with other methods of treatment.

Four cases of orbital cellulitis are cited in which the penicillin therapy was effective.

When used immediately following the Caldwell-Luc operation for periods of a few days, it was found that the discharge ceased promptly and healing was accelerated.

In several cases of infection associated with allergy, the infection was rapidly eliminated through the use of penicillin, which, however, had no effect on the allergy factor.

Monkhouse [80] does not advise the use of sulfonamide compounds in the early stages of acute sinusitis as long as the patient is progressing normally. However, if the patient reaches a stage where irrigation is necessary he is in favor of starting administration of sulfonamide drugs and maintaining the therapy as long as necessary. He recommends a mixture of an aqueous solution of epinephrine, 1:1,000, and ephedrine sulfate, 2 per cent, in a proportion of 60 minims (3.7 cc.) to 1 ounce (28.3 Gm.) of mild silver protein as nose drops in a head position similar to that described by Parkinson. Much of the article is taken up with elementary considerations.

Jorgensen [81] treated 150 patients with disease of the maxillary sinuses by irrigations followed by instillation of a 5 per cent solution of azo-

79. Hansen, I. J., and Work, W. P.: Treatment of Sinusitis with Penicillin, Arch. Otolaryng. **41**:161 (March) 1945.

80. Monkhouse, J. P.: Acute Infection of the Nasal Sinuses, Practitioner **154**:71 (Feb.) 1945.

81. Jorgensen, A.: Lokale Chemotherapie von Empyema sinus maxillaris, Acta oto-laryng. **32**:232, 1944.

sulfamide. There were 72 patients with acute sinusitis who averaged five instillations. There were 56 patients with chronic disease who averaged seven instillations, and 22 patients who had been operated on averaged twelve instillations prior to operation. Examination of tissues removed failed to reveal any damage that could be attributed to the drug. The author claims that the use of the antibiotic was of definite value and superior to any of the drugs previously used, although there is no definite summary of the end results.

Richtner's [82] article is out of date, having appeared in 1942. Nevertheless it shows that despite the war and difficulties of communication our colleagues in Sweden were able to keep abreast of the times. Numerous references to reports on the local use of sulfonamide compounds preface the author's article, in which sulfathiazole and azosulfamide were used in a few cases of acute rhinitis and maxillary sinusitis. It was shown that the bacterial count was considerably reduced in certain cases and hardly influenced at all in others. For instance, Hemophilus influenzae and beta hemolytic streptococci flourished despite repeated local applications of the drug. The author used a 10 per cent suspension of sulfathiazole in isotonic solution of sodium chloride (p_H of 7.5) and declares that ciliary activity was only slightly reduced. He states further that in a series of 30 cases of acute maxillary sinusitis a cure was obtained in an average of six days.

Brunner [83] seeks to evaluate the therapeutic effect of iodized poppyseed oil in chronic infections of the sinuses. He speaks of a "tampon effect" on the mucosa which he believes is manifested in cases in which the emptying of the sinus is accomplished by ciliary action as well as in cases in which emptying is effected by pressure of exudate. He feels that the beneficial action is the result of the oil's protecting the membrane against the action of the exudate and thus "breaking the vicious circle between exudate and membrane." Several cases are cited, and roentgenograms are shown to demonstrate how in some instances the oil will quickly gravitate to the floor of the sinus whereas in others it may float on top of the exudate. The latter circumstance may lead to misinterpretation of the true thickness of the mucosa.

Kern [84] reports successful results from the use of a freshly prepared solution of sulfathiazole (5 per cent) instilled into the nose in the Parkinson position. He states that of a series of 300 consecutive cases

82. Richtner, N. G.: Local Treatment with Sulfathiazole in Certain Acute Inflammatory Conditions in the Nose and Its Accessory Sinuses, Acta oto-laryng. **30**:311, 1942.

83. Brunner, H.: Therapeutic Value of Lipiodol in Paranasal Sinus Infections, Eye, Ear, Nose & Throat Monthly **24**:271 (Aug.) 1945.

84. Kern, E. C.: A Simplified Local Treatment of Sinusitis with Sodium Sulfathiazole, J. M. Soc. New Jersey **42**:89 (March) 1945.

(acute and chronic) cures were obtained in 227 patients while only 30 were unimproved, most of whom subsequently were proved to be allergic. Only 5 cases of hypersensitivity to the drug were encountered. The treatment is preceded by thorough shrinking of the tissues in the middle meatus. The number of treatments necessary average four and four-tenths for the series, with nineteen being the highest. The author believes that the solution reaches into the ethmoid cells and states that roentgenograms would seem to corroborate his claim.

Whalen [85] emphasizes the fact that antibiotics fail to achieve results in the nose comparable to those obtained in open wounds, because of their inability to penetrate the unbroken mucosa. He feels that in many cases the conservative attitude is unwarranted, in view of the pathologic condition which accounts for frequent recurrences. One is prone to consider a patient as cured as soon as the more prominent symptoms have abated. It is his belief that many of these patients can be cured by adequate operation, following which the sulfonamide drugs may be employed with success if used internally as well as locally.

Ornston [86] used a suspension of sulfathiazole microcrystals in a variety of otolaryngologic disorders, with favorable results. Eight out of 11 patients with chronic maxillary sinusitis were cured or definitely improved by irrigation and filling with the solution. He also claims that when it was used by the displacement method in chronic ethmoiditis the amount of discharge and incidence of complications were decidedly reduced.

PHYSICAL THERAPY—MISCELLANEOUS

Kupfer [87] cites numerous authorities to prove that electrical currents possess lethal effects on bacteria as well as stimulating properties when acting on the autonomic centers. He employed a galvanic current in the treatment of sinusitis in a number of instances and reports prompt relief of pain as well as early cessation of discharge. The treatments were given at forty-eight hour intervals and consisted in application of the positive electrode to the nape of the neck and the negative poles to the temporal areas. An ordinary grid battery was rigged up with cells in series and various combinations of plugs provided to supply either "infiltration" or "impulse" technic. The usual treatment was given at an average of 10 volts for periods of ten to fifteen minutes. The electrodes were soaked in plain hot water. The author is convinced that

85. Whalen, E. J.: Chemotherapy of Nasal Sinus Disease, Connecticut M. J. **9**:435 (June) 1945.

86. Ornston, D. G.: Use of Microcrystals of Sulfathiazole in Otolaryngologic Practice, Arch. Otolaryng. **41**:337 (May) 1945.

87. Kupfer, E.: Low Voltage Galvanization in Sinusitis, J. Laryng. & Otol. **60**:68 (Feb.) 1945.

his good results were due to the combined action of the current locally as well as the action on the central nervous system through the positive electrode placed in the vicinity of the medulla.

Simonetti and Buffa [88] report successful results from roentgen therapy in both acute and chronic sinus infections; 41 out of 42 patients in acute cases were cured. Of 27 patients in chronic cases, 20 recovered, 6 were improved and 1 was unaffected. The authors claim better results in infections of the frontal sinus than in those of the maxillary sinus. Also, they emphasize the importance of maintaining the patency of the ostiums and admit that the patients with infection in the antrum get well quicker if irrigations are employed simultaneously. The technic employed closely parallels that customarily followed in this country. Unger [89] claims good results in the treatment of chronic sinusitis from the use of oxygen inhalations. He uses a modified Bennett inhaler attached to an oxygen tank by a rubber tube. The nasal mucosa is shrunk with a vasoconstrictor, and then, with the oxygen flow regulated at 2 liters per minute, the patient fits the inhaler into the nostrils and forcibly exhales into the closed nasal chambers to the point where the pressure is raised to 50 mm. of mercury. This forces the oxygen into the sinuses. Alternate inhalation and exhalation is practiced for fifteen minutes. Too powerful exhalation should be avoided, as it may inflate the ears. The author mentions the possibility of slowing cerebral circulation and increasing intrapulmonary pressure. This may be due to hyperoxygenation. He therefore advises short rest periods during the treatment, especially if the patient complains of the head feeling light.

Remorino [90] described a new antrum trocar cannula, slightly curved at the tip, which has a handle for greater control in the hand and a large enough base to permit aspiration of thick secretions. It is fitted with an an adaptor for irrigation.

CLINICAL CONSIDERATIONS

Proetz,[91] in a timely article, explodes the bugaboo of postnasal drip as a symptom of danger to the patient's health. Citing some eighteen possible causes of this manifestation, he points out that only in a limited number of cases can the mucus be considered a possible menace, these being the instances in which pathogenic bacteria are present in numbers. This is the exception rather than the rule. In most cases the condition

88. Simonetti, C., and Buffa, F.: Roentgenterapia delle sinusiti acute e croniche, Boll. Soc. ital. di med. e ig. trop. **4**:575, 1944.

89. Unger, M.: A New Method of Treatment for Nasal Sinusitis: Oxygen Inflation, Arch. Otolaryng. **41**:353 (May) 1945.

90. Remorino, A.: Trocar-canula para senos maxilares, Rev. méd. de Córdoba **33**:456 (July) 1945.

91. Proetz, A. W.: "Postnasal Drip," Ann. Otol., Rhin. & Laryng. **54**:739 (Dec.) 1945.

is due to living conditions and the continual irritation induced by dust, smoke, tobacco, allergens, thermal changes and similar factors. Treatment of the sinuses is often ineffectual, and relief can be obtained only by removal of the causes wherever possible. In the vast majority of cases the symptom is more of a nuisance than a menace.

Kler [92] made an extensive survey among the employees of a number of plants in the east and midwest over a period of about fifteen months, covering the incidence and causation of colds. Among the facts disclosed are the following: The highest peak is reached in December and January and the lowest in July. The incidence is greater in office workers than among factory workers. Women are more frequently affected than men and particularly during the menstrual period. Sudden drops in temperature increase the number of colds. There are fewer colds in air-conditioned places than otherwise. Activity decreases the percentage of colds. Early treatment seems to be of value in reducing the duration of a cold.

Evans [93] believes that allergy is the greatest factor in the production of symptoms referable to the sinuses, although he also stresses the influence of climate, working conditions, constipation, endocrine disturbances and infections of the teeth. He finds that sulfonamide drugs are of secondary importance to drainage in the therapy of acute infections. Vitamins are much overrated by the laity, and roentgenologic treatment and diathermy are useful in a certain limited field. Conservatism in operation is generally successful, although the author concedes that radical operation when properly indicated should yield permanent results.

Harper [94] is concerned chiefly with an analysis of the so-called silent sinusitis, in which there is a paucity of local symptoms. The condition is suspected from the history and the presence of symptoms apparently unrelated to the local pathologic condition. He cites such conditions as gastrointestinal upsets, mental and psychic disturbances and bronchopulmonary conditions, the origin of which is obscure. Examination of tissues removed from the sinuses at operation in such cases reveals a variety of pathologic changes, including isolated small abscesses in the mucosa, small polypi, fibrosis of the deeper layers, thinning of the bony walls and a deep infiltration of highly virulent bacteria. In many cases the diagnosis can be established by the usual methods. In others the findings are minimal, and one is often forced to enter the sinus on only

92. Kler, J. H.: An Analysis of Colds in Industry, Arch. Otolaryng. **41**:395 (June) 1945.

93. Evans, S. S.: The Care of the Sinus Patient, Memphis M. J. **20**:88 (June) 1945.

94. Harper, J.: Adelantos actuales en el tratamiento de la sinusitis cronica, Día méd. **16**:1495 (Dec. 4) 1944.

slender suspicions based on the history of previous attacks involving these areas.

In children it is particularly important to evaluate the recurrence of colds in association with a generally run-down condition as evidence of a chronic sinus infection and to institute measures aimed at the elimination of the focus. This is particularly true in cases in which removal of the tonsils and adenoids has failed to relieve the symptoms. While the author does not encourage operative procedures in these little patients, relying chiefly on general therapeutics, he states that brilliant results may ensue if the operation is properly indicated.

Roberts [95] believes that chronic nonsuppurative sinusitis is responsible for a long train of symptoms, such as postnasal discharge, fatigue, alimentary obstruction, suboccipital and other neuralgic pains and allergic phenomena. He claims that the cause is to be found in a disturbance of the colloid balance, which can be traced to dietetic and hygienic indiscretions. It is necessary that such patients be analyzed thoroughly from a general point of view, and the author submits a long questionnaire which the patient fills out at his leisure and which furnishes the physician with detailed information on such subjects as hours of sleep, exact amounts of various foods taken, liquor and tobacco consumption and symptoms from which one may determine whether the person is predominantly sympathetic or parasympathetic. An analysis of the patient's habits furnishes the physician with information on which he may base his therapy. The dietary deficiencies are corrected, smoking interdicted, sweets eliminated and vitamins given in various combinations according to the indications.

The article is sound and informative and furnishes a basis for the intelligent care of many chronic complainers who get nowhere when restricted to local therapy alone.

Shahinian's article [96] is a résumé of the symptoms, diagnostic findings and therapeutic indications of sinusitis in general, with references to the literature.

AEROSINUSITIS

Wright and Boyd [97] define aerosinusitis as an acute or chronic inflammation caused by trauma to the mucosa resulting from the differences in air pressure within the sinus and the surrounding atmosphere, due to changes in altitude during airplane flights. After discussing the mechanical factors, which are now well known, they mention the symp-

95. Roberts, S. E.: Diagnosis and Treatment of Non-Suppurative Sinusitis, Arch. Otolaryng. **42**:198 (Sept.) 1945.

96. Shahinian, L.: Sinusitis: Revised Diagnostic and Therapeutic Concepts, Stanford M. Bull. **3**:30 (Feb.) 1945.

97. Wright, R. W., and Boyd, H. M. E.: Aerosinusitis, Arch. Otolaryng. **41**:193 (March) 1945.

toms of acute pain, stuffiness and nosebleed and give a brief résumé of the experimental work up to this time, leading to an explanation of the pathologic changes which bring these about.

The authors studied a number of aviation students in the low pressure chamber as well as those who had recently been on flights and a group of patients exhibiting nasal pathologic conditions. Their observations are based on local examinations, roentgenograms, results of irrigation and operative findings. Obstructing pathologic tissue was found to be a potent factor in the incidence of aerosinusitis, being particularly active when changes in altitude were rapid.

According to the authors, the presence of nasopharyngitis or a deviated septum did not seem to be so great a determining factor in the production of aerosinusitis as is generally supposed, although they admit that in some cases resection of the septum was effective in preventing further trouble.

From the symptomatologic-pathologic standpoint, the authors found aerosinusitis falling into a number of groups, such as acute rhinitis, beginning chronic sinusitis, central frontal pain, deviated septum, chronic sinusitis with or without polyps, allergy and cases with no pathologic findings.

Immediate relief can be obtained by ascent in a pressure chamber followed by the use of vasoconstrictors. Other conditions are treated according to the pathologic findings.

Campbell [98] likwise defines aerosinusitis as an acute or chronic inflammation due to barometric pressure differences between the air within the sinuses and that of the surrounding atmosphere. It is characterized by local pain, swelling of the sinus mucosa and hemorrhage into the submucous tissues. The changes within the sinus lining may be temporary or permanent, depending on the degree of trauma. Much valuable information was obtained through observations on a large series of aviators in training who were subjected to tests in decompression chambers. In addition, experiments on animals followed by autopsy studies, roentgenograms of sinuses before and after flight and, in some instances, operative findings in selected cases have shown the various degrees of pathologic change which may ensue on trauma to the mucosa induced by differences in air pressure. In a series of thirty-five thousand simulated flights the incidence of aerosinusitis was 1.9 per cent, whereas in a similar series of nine thousand man flights only 0.05 per cent displayed sinus symptoms requiring hospitalization. The frontal and maxillary sinuses were most frequently affected, and the findings ranged from clouding on roentgenologic examination to definite rupture of the mucosa and the formation of submucous hematoma.

98. Campbell, P. A.: Aerosinusitis: A Résumé, Ann. Otol., Rhin. & Laryng. **54**:69 (March) 1945.

Schneider's[99] article on aerosinusitis is well illustrated with numerous roentgenograms showing pathologic changes of the frontal and maxillary sinuses resulting from sudden changes in air pressure incident to altitude flying. Mucosal swelling, hematomas and fluid can be demonstrated in the pictures, which are extremely instructive. The mechanics responsible for these changes are explained as they have been in articles on this subject previously appearing in the literature. The principal symptoms in these cases are sudden, severe pain over the affected sinus, appearing abruptly during descent from a high altitude. Relief may be obtained by an immediate reascent to a higher altitude, followed by slow descent, and continuous and persistent shrinkage of the nasal mucosa in the region of the sinus ostium. The earlier this therapy is instituted and the more persistently it is continued, the better the chances of recovery. Local heat and codeine are helpful in relieving the pain.

McGibbon [100] submits a thorough analysis of 145 cases of barotrauma encountered among flying personnel. Some of the significant items mentioned are listed: 1. Symptoms develop during descent in 64.7 per cent, during ascent in 24.1 per cent and during level flying in 13.7 per cent. 2. The pain was experienced in the frontal region in 94.4 per cent, although roentgenologic evidence of involvement of the frontal sinus was found in only 35.1 per cent. 3. Positive roentgenologic findings were observed in 75 per cent of the cases. 4. A few cases of malingering were uncovered (about 5 per cent). 5. Acute and chronic infections of the upper respiratory tract were the commonest contributing factors. 6. If seen early, some patients may be benefited by equalization of air pressure in the low pressure chamber. 7. Sixty-eight per cent of the group were admitted to the hospital and over half of these were subjected to some operative procedure. 8. The prognosis generally is good; 82 per cent of the patients were able to resume full flying duties. 9. Only 1 proved case of submucous hemorrhage was encountered. The condition failed to resolve in five months.

Bateman [101] surveyed a group of 156 aviators complaining of symptoms referable to the sinuses as a result of sinusitis. His objective was mainly to "evaluate the influence of infective nasal sinusitis, past or present, on a man's flying career." The patients were grouped according to the time of appearance of the pain in three groups, namely (1) those in whom the symptoms were present only during flying and in whom

99. Schneider, M.: Aerosinusitis: A Clinico-Roentgenological Study, Am. J. Roentgenol. **53**:563 (June) 1945.

100. McGibbon, J. E. G.: Nasal Sinus Pain Caused by Flying (the Syndrome of Sinus Barotrauma): An Analysis of One Hundred and Forty-Five Cases, J. Laryng. & Otol. **59**:405 (Nov.) 1944.

101. Bateman, G. H.: The Effect of Sinusitis on Flying Personnel, J. Laryng. & Otol. **60**:110 (March) 1945.

roentgenologic evidence of sinusitis was present, (2) those in whom the symptoms occurred on the ground with some aggravation during flying and (3) those whose symptoms developed on the ground sufficiently to prevent flying until they had recovered.

By far the commonest symptom was pain in the frontal region; other patients (the minority) had pain in the cheek, aural trouble, catarrh and similar symptoms.

The author makes a point of differentiating headache due to sinus involvement from headaches of psychogenic origin. In the former headaches local pain is the only symptom complained of, whereas in the latter other symptoms will be discovered which will lead to discovery of the underlying psychosis. Such things as irritability and insomnia preceding flight and increased consumption of cigarets and alcohol are usually found in association with the headaches and will persist as long as the person is in the flying unit. Sinus headache is typically frontal and is often described as a feeling of having been "stung on the forehead by a bee" or "hit over the forehead with a crowbar" induced or aggravated by loss of altitude during flying and persisting for some time after landing. It is interesting to note that of the group complaining of symptoms in the air only 54 per cent returned to full flying duty; of those with symptoms on the ground only, 80 per cent returned to duty, and of those with symptoms in the air and on the ground, only 32 per cent resumed flying.

Characteristic frontal pain was associated with positive roentgenologic findings, particularly the characteristic dome-shaped swelling previously described by other observers and corroborated by the author.

The results following operative treatment were better than those in patients treated conservatively. This is attributed to the fact that operations were perfomed only when strict indications were present, whereas in many patients treated conservatively the presence of conditions concerning the sinus could not be definitely linked to the pains in an etiologic sense.

The author found that some persons could fly in comfort despite acute sinusitis. Also, acute sinusitis which responded to therapy normally does not cause any lasting flying disability. Also, even though sinusitis may incapacitate the person for flying. "there is no evidence to show that the course of the disease has been adversely affected by flying."

Wadon [102] discusses the mechanics of sinus obstruction in aviators due to sudden changes in air pressure, a subject that has been extensively covered in our own literature. Nothing new is added. The symptoms are mentioned, and stress is laid on the importance of rejecting aviators

102. Wadon, A.: The Problem of Ventilation of the Paranasal Sinuses, Lek. wojsk. **36**:56 (Feb.) 1945.

for dive bombing and similar activities if they have any disposition to blockage of the ostiums either from swelling or from anatomic states or other causes.

TRAUMA (FOREIGN BODIES)

Haffly [103] demonstrates the importance of routine roentgenograms in all cases of trauma to the head. He cites the case of a soldier wounded in the left orbital region by a shell fragment, which necessitated removal of the eye. After primary healing and removal to another hospital, roentgenograms revealed a foreign body below the orbit, which at operation proved to be a shell fragment 4 by 1.75 cm. lying firmly wedged within the antrum.

Longo [104] reports a case of fracture in the frontal region resulting from a kick by a horse. Following a brief period of unconsciousness, the symptoms that appeared were headache, mental confusion, external purulent drainage from the wound and a watery discharge from the nose. Roentgenograms revealed a large pneumatocele in the right frontoparietal region (intracranial) and a comminuted fracture of the posterior wall of the frontal sinus extending into the ethmoid sinus. Spinal puncture disclosed fluid under slight pressure, 24 cells per cubic centimeter (mostly lymphocytes) and positive Pandy and Nonne reactions.

An incision over the supraorbital margin, extending across the root of the nose, was made. Pus was encountered in moderate amounts issuing from a defect in the external table. Both frontal bones were irregularly fractured into both frontal sinuses. Masses of degenerated mucosa were found mingled with pus and bone fragments. When these were cleared away, examination of the posterior wall revealed an extensive fracture, with exposure of the dura in a good-sized defect of the bone. Secretion was found oozing from a small aperture in the dura. The dura was opened widely, and, after the frontal lobe had been probed to a depth of 3 to 4 cm., about 5 cc. of a serosanguineous fluid was aspirated, followed by air. With appropriate drainage and postoperative care, the patient made a successful recovery.

Christiansen and Bradley [105] report a case of chronic suppuration of the maxillary sinus following a gunshot wound through the face. The external wound healed, but due to fragmentation of the antral wall and alveolar ridge a secondary infection ensued, with a draining fistula into the mouth. Roentgenograms show the diseased antrum, and photo-

103. Haffly, G. N.: Value of Routine Roentgenographic Studies of War Injuries of the Head and Neck, Arch. Otolaryng. **41**:216 (March) 1945.

104. Longo, P. W.: Pneumatocele por traumatismo du regiao frontal, Arq. neuro-psiquiat., São Paulo **3**:52 (March) 1945.

105. Christiansen, G. W., and Bradley, J. L.: Caldwell-Luc Operation for Chronic Maxillary Sinusitis of Traumatic Origin, Mil. Surgeon **96**:406 (May) 1945.

graphs are presented to show the course of the fistula. The patient recovered after a Caldwell-Luc operation.

Two interesting cases of foreign bodies in the maxillary sinus are reported by Howard.[106] The patient in the first case was a man of 22 who gave a history of having been struck from behind and knocked unconscious. A laceration in the cheek was sutured. About a year later he complained of severe headaches. The left nostril was found full of pus and crusts, and roentgenologic examination revealed a knife blade extending through the antrum from the zygomatic bone down through the septum into the hard palate. It was removed by combined traction from the point of entrance as well as through the antrum, which was opened by a sublabial approach. The weapon measured 5¾ inches (14.6 cm.) in length and was rusty. The sinus was filled with pus and polypoid membrane.

The patient in the second case was a woman of 56 who broke off a tooth while eating some hard candy. Probing through the socket of the first right upper molar by a dentist failed to reach the foreign body. It was finally removed by way of a nasoantral window.

Brown [107] reports a case of extreme destruction within the nose due to infestation with screw worms (Cochliomyia americana) in a man of 55. He gave a history of having had a fly enter his nose a few days previously, resulting in pain and fever. The side of the nose was filled with worms, which persisted in appearing despite irrigations with 50 per cent chloroform and water. Both sides of the nose were infested, and the worms caused a destruction of the septal cartilage and perpendicular plate and ulceration extending into the ethmoid sinus, which soon necrosed. Eventually both middle turbinates were destroyed, and the ulceration extended backward to involve the entire nasopharynx. When the process was finally halted the patient suffered an ozena-like condition, with foul-smelling crusts, which persisted for a number of months.

The author cites similar cases previously reported and describes the life cycle of the insect.

Rhinoliths of the antrum are extremely rare, and the case reported by Lord [108] is extremely interesting. The patient was a man of 50 who underwent a radical operation on the maxillary sinus for the cure of a chronic infection of some years' standing. At operation an irregularly shaped stony mass was removed, measuring 18 by 13 by 6 mm. and weighing 720 mg. The nucleus was found to consist of a small wad of paper, in which several printed letters could be made out. The body

106. Howard, J. C., Jr.: Foreign Bodies of the Maxillary Sinus, Ann. Otol., Rhin. & Laryng. **54**:186 (March) 1945.

107. Brown, E. H.: Screw Worm Infestation in the Nasal Passages and Paranasal Sinuses, Laryngoscope **55**:371 (July) 1945.

108. Lord, O. C.: Antral Rhinoliths, J. Laryng. & Otol. **59**:218 (June) 1944.

of the mass consisted of calcium phosphate, a small amount of carbonate and some organic matter. The author believes that the paper was inserted into the nose some time in the patient's childhood and found its way into the antrum, where in time it formed the nidus for the accumulation of precipitated salts.

ALLERGY

Hald,[109] in the course of an analysis of 200 patients who were examined for allergy because of nasal smptoms, found 23 who had previously undergone operation on the maxillary and ethmoid sinuses, with unsatisfactory results despite removal of practically all the mucosa. The original indications for these operations were in most cases the classic findings of purulent discharge, polypi, cloudiness and similar symptoms. All these patients proved to be allergic, as determined by the associated symptoms, history of the cases and the eosinophilia, which was as high as 28 per cent in 1 case and exceeded 4 per cent in nearly half of the entire series. An interesting observation in this study was the incidence of anosmia, which was present to a greater or lesser degree in 36 per cent of all patients.

Jensen [110] examined 44 patients previously operated on for sinus disease with recurrence and found a high incidence of allergic stigmas, such as a family and personal history of sinus disease, eosinophils in the nasal secretion and typical edematous mucosa. Some of the patients had been operated on a number of times, 34 of them having undergone a Caldwell-Luc operation. It is interesting to note that the cutaneous tests were not very conclusive, and the author feels that greater reliance may be placed on the anamnesis and microscopic observations.

King [111] found allergy to be a potent factor in the symptomatology usually attributed to sinus disease. A survey of the cases observed over a six months period from January to July showed 75 per cent of the patients with nasal symptoms to be allergic. The percentage varied with the season, being as low as 50 per cent in February and as high as 100 per cent in June. In most cases he found it necessary to do only a few tests for the commoner offenders.

MAXILLARY SINUSES (DENTAL)

Hersh [112] reports a case of maxillary sinusitis in a 32 year old soldier which was due to Actinomyces necrophorus and a symbiotic anaerobic

109. Hald, E.: Two Hundred Cases of Allergic Nasal Affections, Acta otolaryng. **31**:23, 1943.

110. Jensen, A. P.: Polypous Nasal Sinus Affections and Allergy, Acta otolaryng. **30**:440, 1942.

111. King, E.: Colds, Sinusitis and Allergy, Cincinnati J. Med. **25**:495 (Jan.) 1945.

112. Hersh, J. H.: Primary Infection of Maxillary Sinus by Actinomyces Necrophorus, Arch. Otolaryng. **41**:204 (March) 1945.

streptococcus. The symptoms were stuffiness, nasal discharge and, later, pain and tenderness in the cheek. Pus flowed freely through the antrum trocar, which revealed the organisms mentioned. Treatment with zinc peroxide, sulfadiazine, iodine and thymol failed to influence the process. Penicillin seemed to diminish the discharge, but the patient did not recover until he had undergone a Caldwell-Luc operation, which revealed a far advanced degeneration of the mucosa with numerous polypi. The author states that there are only 10 previously reported cases of maxillary sinusitis due to a fungus.

In Bager's case [113] a body of 14 was hospitalized with a diagnosis of sinusitis eight days after an attack of sore throat. He had slight meningeal symptoms, striking evidence of acute maxillary sinusitis and but little angina. The blood count revealed 13,200 white cells, of which 75 per cent were mononuclears. The heterophilic antigen was plus 8. Puncture of the sinus yielded 5 cc. of a yellowish viscous fluid. The author believes that the sinusitis was a manifestation of the infectious mononucleosis.

Christiansen and Bradley [114] report recovery of a third molar from the antrum via a Caldwell-Luc operation. The tooth was pushed up into the sinus during an attempted removal. Roentgenograms reveal the foreign body clearly.

MacGougan [115] cured 2 patients with antrum infection of dental origin by irrigations through a puncture in the inferior meatus, followed by a 20 per cent suspension of sulfathiazole powder in glycerin. In both cases the condition followed tooth extraction, two years previously in 1 instance and a few weeks in the other. The first patient recovered after seven treatments and was free from discharge and clear on transillumination one month later. The second patient required extraction of a portion of root remaining and plastic closure of the alveolar fistula. This patient was well after several treatments and had no recurrence up to five months, when last seen.

Lage and Lage [116] mention the various anatomic variations responsible for the rapid spread of infection from the upper molars to the antrum and cite 3 cases. In all of them the root of the tooth either penetrated the floor of the sinus or was in close proximity to it. Symptoms followed extraction in 2 cases and penetration of the needle employed in cleaning out a root.

113. Bager, C. C.: Maxillary Sinus Exudate as a Manifestation (?) of Infectious Mononucleosis, Acta oto-laryng. **30**:536, 1942.

114. Christiansen, G. W., and Bradley, J. L.: Maxillary Sinus Surgery via a Caldwell-Luc Window, J. Am. Dent. A. **32**:859 (July) 1945.

115. MacGougan, M. K.: Maxillary Sinusitis of Dental Origin: Two Cases Treated Conservatively, J. Canad. M. Serv. **2**:579 (July) 1945.

116. Lage, C. C., and Lage, O. J.: Infecções e anomalias dentárias causas também das sinusites, Publ. méd., São Paulo **16**:61 (Dec.) 1944.

FRONTAL AND ETHMOID SINUSES

Andersen [117] reports a case of accidental penetration of the frontal sinus through a mistaken reading of roentgenograms. The case was one of bilateral frontal sinusitis. A Kuhnt operation was planned, but on one side the cotton plug introduced through the opening into the bone fell into the depth. Further examination showed that what appeared in the roentgenogram to be a frontal sinus was only a small indentation of the opposite sinus. The patient recovered under sulfonamide therapy.

The same author [118] also reports the interesting case of a 64 year old woman subjected to negative pressure with a "Sorensen aspirator in whom severe frontal pains developed. Roentgenograms showed the sinus extremely dark. At operation it was found to be filled with masses of brownish red blood.

Hickey [119] discusses the mechanics of fistula formation in the frontal sinus, citing numerous reports from the literature, illustrating various types of causes and reporting 3 cases. In addition to tumors, carcinoma, mucocele and tuberculosis, he finds that suppuration is more frequently the cause of fistula in chronic cases than in acute cases or in osteomyelitis, although instances of the last are frequently noted.

Negri [120] describes a case of acute frontal sinusitis and analyzes the symptoms on the basis of existing pathologic conditions. Therapy consists of methods to facilitate intranasal drainage and the administration of antibiotics. If these fail to give relief he recommends an external opening.

After a careful summary of previous contributions on the subject of hyperostosis frontalis interna, Braun [121] presents an analysis of 46 cases discovered in a routine series of nine hundred and seventy-three roentgenograms of the skull taken at the Joseph H. Pratt Diagnostic Hospital during a period of over three years. Ninty-three per cent of the conditions occurred in women and 7 per cent in men. From an analysis of the symptoms, the author concludes that the conditions in his cases conformed more nearly to the description of Stewart-Morel, in which the neuropsychiatric symptoms predominate. He failed to find a single case of the so-called classic Morgagni syndrome, comprising hyperostosis, virilism and obesity. The average case in his group indicated a woman of

117. Andersen, H. C.: Asymmetry of the Frontal Sinuses as a Cause of an Accidental Dura-Cerebrum Lesion, Acta oto-laryng. **30**:528, 1942.

118. Andersen, H. C.: Frontal Hematosinus After Suction, Acta oto-laryng. **30**:528, 1942.

119. Hickey, H. L.: Some Lesions Associated with Fistula of the Frontal Sinus, Ann. Otol., Rhin. & Laryng. **54**:143 (March) 1945.

120. Negri, R. L.: Consideraciones sobre sinusitis frontal aguda, Día méd. **17**:257 (March 26) 1945.

121. Braun, W. H.: Hyperostosis Frontalis Interna, Bull. New England M. Center **6**:267 (Dec.) 1944.

about 45 "quite obese, with marked psychoneurotic tendencies, a low basal metabolism rate, hypertension, and possibly diabetes; in addition, presenting complaints would be severe prolonged headache of the so-called 'pressure' type, muscular weakness, and the usual symptoms associated with the classical anxiety state." Therapy up to the present time has in most cases been ineffective.

De Montmollin [122] reports 2 cases of hyperostosis frontalis interna, occurring in a mother (aged 81) and daughter (aged 54). As in other reports of cases of this type, this one also includes a discussion of the cause and pathogenesis. The author believes that the syndrome of Morel is a neuroendocrine disorder manifesting itself in ectomesodermic tissues and is undoubtedly hereditary.

Suarez [123] reports an early case with clinical symptoms of protracted headaches and insomnia of a year's duration and roentgenologic findings of the condition in the frontal bone. There is no mention of the other signs usually associated with this condition. The author gives a brief summary of the theories that have been advanced as to causation.

Mascheroni, Reussi and Milli [124] feel that heredity plays an important role in the incidence of hyperostosis frontalis interna and cites the condition occurring in 2 sisters. In 1 of the cases the thickening involved all the bones of the calvarium, while in the other the hyperostosis was limited to the frontal bone. The authors call attention to the protracted headaches, of long standing, which were an outstanding symptom.

Fauvety [125] summarizes as follows: There seems to be a hereditary predisposition to the disease which is of a somatotropic character and may be associated with a disturbance of the anterior part of the pituitary. There is no proof that the syndrome is directly related to either local or general infections or to arteriosclerosis. Aside from the hyperostosis, there is no characteristic symptom or clinicosemeiologic sign that is diagnostic except the roentgenologic findings. It is likely that a relationship exists between the psychic manifestations and other endocrine and metabolic signs and the extent, magnitude and anatomic location of the hyperostosis. The functional manifestations arising from cortical or tuberoinfundibular and hypophysial dysfunction could be the result of direct pressure or disturbances of the arteriovenous circulation and cerebrospinal fluid.

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122. De Montmollin, R.: Hyperostose frontale interne familiale, Rev. neurol. **73**:15 (Jan.-Feb.) 1941.

123. Suarez, R. M.: Hyperostosis frontalis interna, Bol. Asoc. méd. de Puerto Rico **36**:468 (Nov.) 1944.

124. Mascheroni, H. A.; Reussi, C., and Milli, R.: Hiperostosis frontal interna en dos hermanas, Rev. méd.-quir. de pat. fem. **23**:571 (Sept.) 1944.

125. Fauvety, J. C.: Hiperostosis frontal interna, Rev. méd.-quir. de pat. fem. **23**:489 (Aug.) 1944.

Beck [126] reports 2 cases of abscess of the septum complicating acute ethmoiditis in both of which the patients were young persons. The second case was serious: The patient had pansinusitis with evidence of orbital involvement, external swelling and signs suggesting possible meningeal involvement. An external approach to the ethmoid sinuses disclosed a subperiosteal abscess in the orbit and pus in the frontal and ethmoid sinuses and the antrum. A few days later a large abscess of the septum was evacuated. A number of references to the literature are discussed, with theories advanced as to the probable pathways of infection. Extension by continuity of tissues is the most probable explanation.

MISCELLANEOUS

Williams [127] distinguishes deep-seated pain in the head from superficial pains, the former being generally due to allergy whereas the latter are usually caused by sinusitis. Tenderness of muscles of the neck and head was observed following exposure to chilling, changes of temperature and emotional disturbances. A study of 118 cases revealed a tendency to unilateral localization of the pain, which is deep seated and "tends to be referred in a distribution which is not that of the spinal roots." Seventy-two patients with various myalgias about the head and neck were treated with injections of nicotinic acid, 100 mg. daily; later it was given by mouth. Fifty-four of this group obtained relief.

Metz [128] reports a case of spontaneous cerebrospinal rhinorrhea in a woman of 58, following an attack of bronchitis. The flow persisted day and night for about a year. A small ball of cotton placed in front of the middle turbinate against the lamina cribrosa blocked the flow. Consequently, the area was cauterized with a 20 per cent silver solution at three week intervals. The rhinorrhea ceased for nine months, and when it recurred it yielded to a single lumbar puncture.

Macdonald [129] assembled statistical data bearing on spontaneous cerebrospinal rhinorrhea and presents a summary of the information thus obtained. Some thirty-five references are listed and the cases grouped according to the known and surmised sources of the discharge, the etiology, the pathology and the treatment. Whereas formerly the therapy was restricted to rest and abstinence from local therapy, the

126. Beck, A. L.: Abscess of the Nasal Septum Complicating Acute Ethmoiditis, Arch. Otolaryng. **42**:275 (Oct.) 1945.

127. Williams, H. L.: The Syndrome of Physical or Intrinsic Allergy of the Head: Myalgia of the Head (Sinus Headache), Proc. Staff Meet., Mayo Clin. **20**:177 (June 13) 1945.

128. Metz, O.: Cerebrospinal Rhinorrhoea, Acta oto-laryng. **30**:523, 1942.

129. Macdonald, R.: The Occurrence of Spontaneous Cerebrospinal Rhinorrhoea in the Literature, the Experience of the Writer and Other Diplomates of the American Boards of Otolaryngology and Neurosurgery, Laryngoscope **55**: 552 (Oct.) 1945.

author notes recent trends toward surgical repair and the use of chemotherapy, which he believes offer a better prognosis that the erstwhile "let alone" policy.

Ford [130] records a case of duodenal ulcer in a man of 71, which she is convinced was due to a sinus infection. The attacks of hematemesis and melena subsided after the sinuses had been treated by drainage. Recurrence of the vomiting and other symptoms brought the patient to a critical state during a period when the attending physician suspended the nasal treatments. The author was then called in again and found the patient too weak to submit to even the mildest nasal therapy. However, after the patient's bald head was painted with dilute acetic acid for ten to fifteen minutes twice daily, thus "reflexly stimulating the nerve endings of the fifth nerve," a flow of mucus was induced, which seemed to give the patient relief, so that he was soon able to take food. This therapy was continued for three weeks as the patient gained appetite and strength, until he was able to resume local nasal therapy. (The scalp had become too sensitive to permit further applications of acetic acid.) Eight months later an acute abdominal episode resulted in an operation which revealed a healed duodenal ulcer the size of a half crown. (Acute appendicitis was found to be the cause of the attack.) The patient lived comfortably for ten years and died of some intercurrent disease.

Post [131] cites a number of cases of fliers in whom anxiety states were responsible for symptoms frequently associated with sinus disease. During the stage of excitement the symptoms were more likely to simulate an allergic syndrome. The letdown after a crisis usually produced symptoms of turgescence with nasal blockage and headaches. Analysis of a number of cases indicated a rather close connection between certain anxiety states and disturbed nasal function, the solution of which was obtained only after proper psychotherapy.

Because of the atrophic changes affecting the nasal and sinus mucosa in aged persons and the tendency to complications in infections of the upper respiratory tract, Rosenwasser [132] stresses the importance of the early treatment of the common cold in these persons. They should be put to bed, turned frequently and given steam inhalations, aqueous nasal sprays and general supportive measures. In cases in which there is a suggestion of impending sinus or aural infection, sulfadiazine should be administered. Good nursing is important, and attention

130. Ford, R.: Nasal Sepsis and Duodenal Ulcer, Clin. J. **74**:190 (Sept.-Oct.) 1945.

131. Post, W. L.: Nasal Psychosomatic Syndrome Accompanying and Following Acute Anxiety, Ann. Otol., Rhin. & Laryng. **54**:747 (Dec.) 1945.

132. Rosenwasser, H.: Infections in the Nasal Accessory Sinuses and the Ears in Old Age, Arch. Otolaryng. **41**:182 (March) 1945.

should be paid to the care of the skin which in aged persons has a tendency to be dry and atrophic.

Dysart [133] states that diabetic gangrene of the nose is extremely rare; he was able to find only 15 cases reported in the literature, most of which are cited in brief. The factors which bring about this severe complication are local infection, acidosis and thrombosis of a terminal artery. The author reports the following 3 cases. The patient in case 1 was a man of 52 with a history of diabetes over a period of almost twenty years. The local lesion was a necrotic area in the hard palate 3 by 1.5 cm. After removal of the dead tissue it was noted that most of the inferior turbinate, all the middle turbinate and the ethmoid capsule had disappeared. A large defect resulted in the hard palate. The patient improved under general treatment but died a year later, as a result of an automobile accident. The patient in case 2 was a woman of 47. The local lesion was a dark swollen area in the hard palate and an ulcerated area on the left side of the temple. The patient was in a semicomatose condition at the time and succumbed within a week. The patient in case 3 was a man of 69. He showed a red swollen area under the left eye. Later an ulcer developed, extending to the lacrimal sac and side of the nose. Also there was a necrotic area on the alveolus. The necrotic areas separated eventually, leaving a large opening into the antrum. The patient's general condition worsened, and death ensued within a year.

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133. Dysart, B. R.: Diabetic Gangrene Involving the Sinuses, Arch. Otolaryng. **41**:143 (Feb.) 1945.

Abstracts from Current Literature

Ear

THE SELECTION OF HEARING AIDS. H. DAVIS, C. V. HUDGINS, R. J. MARQUIS, R. H. NICHOLS JR., G. E. PETERSON, D. A. ROSS and S. S. STEVENS, Laryngoscope **56**:85 (March) 1946.

This work was initiated at the Psycho-Acoustic and Electro-Acoustic Laboratories of Harvard University. It concerns broadly all electroacoustic instruments, both as to their physical properties and as aids to hearing.

The differences between corresponding models of the leading manufacturers are relatively slight, and future improvement will probably not be great. The best frequency adjustment for an aid for most ears is one that can be made either uniform or accentuated in the high tones. The maximum acoustic output should not exceed the tolerance of the patient. In most cases minor variations from the ideal frequency characteristic are not important, and detailed "fitting" of the aid is unnecessary.

The kind and cause of hearing loss has to be taken into consideration as well as the selection of a hearing aid.

Complete compensation of hearing loss is usually impossible because the tolerance of an impaired ear prohibits more than a certain amplification.

The authors list and discuss the various qualities and what can be expected from hearing aids. There must be a compromise between the theoretic maximum and the practical benefit that a hearing aid can produce.

Various methods of fitting hearing aids are discussed. Neither an audiogram nor an equal loudness contour helps greatly. A single versatile instrument of appropriate general characteristics, with a variable tone control and a semipermanent adjustment of maximum acoustic output, is best. Detailed specifications for such an aid are given.

HITSCHLER, Philadelphia.

COMPOSITE FREE GRAFTS OF SKIN AND CARTILAGE FROM THE EAR. J. B. BROWN and B. CANNON, Surg., Gynec. & Obst. **82**:253 (March) 1946.

The authors propose the use of free grafts, consisting of two surfaces of skin with cartilage between, for the replacement of defects of the border, tip or columella of the nostril. Since a satisfactory blood supply is necessary, the required graft will of necessity be larger than the original defect. The maximum width is about 1 cm., length being considered unimportant. The crux of the helix seems to be the source of choice. Repair of the ear is accomplished by a local flap or by burying the open ear under a direct scalp flap from behind. Satisfactory reconstruction of the nasal defect may be accomplished by a single operation.

FRIEDBERG, Chicago.

ACUTE MASTOIDITIS FOLLOWING SULFONAMIDE THERAPY. LYLE M. SELLERS, Texas State J. Med. **40**:297 (Sept.) 1944.

The article includes a somewhat detailed report of 4 cases of acute surgical mastoiditis following sulfonamide therapy and a brief review of the literature on the subject. In commenting on the cases reported, the author states that in some cases in the series edema and tenderness were present; in others one or the other was absent. In some the otorrhea was profuse and purulent; in others it was scanty or absent. In some the temperature was septic; in others it was fairly normal. In some the blood cell count was raised and showed shifting to the left;

in others it was normal or decreased. In 1 case the necrosis was "spotty"; in the others it was generalized and extensive. In some the course was retarded; in others it was fairly progressive. In some the culture was positive; in others it was negative. In no case was the opacity of the roentgenogram decreased. As a result of these facts the author does not agree with a published report that sulfonamide therapy in acute suppurative otitis media produces a definite clinical entity; the clinical picture is clouded, but there is no definite characteristic picture. Each case is a clinical entity of its own, and normal roentgenograms are not to be trusted. If one suspects surgical mastoiditis following sulfonamide therapy, the patient should be given the benefit of the doubt and should be operated on.

SINGLETON, Dallas, Texas.

COMPLICATIONS OF CHRONIC OTITIS MEDIA. LOUIS DAILY and JOHN L. DEAN, Texas State J. Med. **40**:590 (March) 1945.

The authors report in detail a case of chronic otitis media, without discharge, complicated by brain abscess. The patient, a white man, entered the hospital complaining of severe headache and pain above the eyes. On admission to the hospital his temperature was 103.6 F., pulse rate 88 and respiratory rate 28. He had moderate nuchal rigidity, and the head was drawn slightly backward. Examination of the spinal fluid on the day following admission to the hospital showed no increased pressure, but the cell count was 1,070, 10 per cent lymphocytes and 90 per cent polymorphonuclears. A radical mastoidectomy performed five days after the patient entered the hospital revealed pus in the antrum under pressure. The dura of the middle fossa was exposed and covered with pus. The dura was further exposed and incised. The knife was extended into the brain tissue over 1 inch (2.5 cm.), and foul pus under pressure drained from the incision. The opening into the abscess cavity was enlarged by insertion and opening of a hemostat. The cavity, which was large, was evacuated by suction and was packed with iodoform gauze incorporated with sulfanilamide powder, and a rubber tissue drain was inserted. Convalescence was stormy, but the patient recovered.

An outline differentiating between abscess of the temporal lobe and cerebellar abscess is given as follows:

Temporal Lobe Abscess	*Cerebellar Abscess*
1. More often in children.	1. More rigidity of neck.
2. Aphasia; alexia frequently present.	2. Amaurosis.
3. Hemianopsis.	3. Vertigo more marked.
4. Conjugated deviation of head and eyes toward side of disease.	4. Vomiting more marked.
5. Vertical nystagmus if abscess ruptures into ventricle, but a cerebellar abscess might also rupture into ventricles.	5. Ataxia more marked.
6. Occasionally nystagmus toward diseased side.	6. Adiadochokinesis.
	7. If eyes deviate to the healthy side, it is most likely a cerebellar abscess.
	8. Equilibrium disturbance and no coordination.
	9. Tender reflexes disturbed much less.

The incidence of chronic otitis media in the adult population is given as ranging from 3.5 to 5 per cent. In their concluding paragraph, the authors state that the radical mastoidectomy should be performed oftener to prevent complications of chronic otitis media.

SINGLETON, Dallas, Texas.

THE TREATMENT OF OTITIS MEDIA. COLIN M. JOHNSTON, J. Laryng. & Otol. **60**:303 (Aug.) 1945.

Johnston discusses the various methods used in the treatment of chronic suppurative otitis media. He stresses first the correct appreciation of and the thorough treatment of the causes of otitis media. He feels that thorough treatment of the nose, paranasal sinuses and nasopharynx is essential to the successful treatment of chronic otitis media. In his opinion, the maxillary sinus is the greatest offender in the causes for chronicity of disease of the middle ear.

He states that the most essential part of conservative treatment of a suppuration is the removal of pus and debris from the meatus at frequent intervals. He stresses the surgical or chemical removal of granulation tissue and the use of irrigations of the attic.

His statement on the choice of type of medicament is worthy of direct quotation. "The choice of medicament to be inserted into the ear after cleansing lies between a powder or liquid. If, in the absence of cholesteatoma, there is a little mucosal swelling in the middle ear and a large perforation allowing free drainage, a thin dusting of powder will reduce the secondary infection from the meatus by its antiseptic action and absorption of moisture. I have found that a profuse discharge rapidly washes away the powder and does not usually give such good results, and therefore confine its use to cases where the discharge is sufficiently scanty for one to be able to see traces of powder remaining at the next treatment."

LEJEUNE and FARRIOR, New Orleans.

Pharynx

FOCAL INFECTION IN THE PHARYNX. DAVID DAVIS, Laryngoscope **56**:180 (April) 1946.

Davis points out that the removal of diseased tonsils does not mean the removal of all foci of infection in the throat. Many times small bits of lymphoid tissue, including the lingual tonsil, tonsillar stubs, lymphoid tissue on the posterior part of the pharynx, the adenoids and the lateral pharyngeal bands, are diseased and constitute a focus of infection. Small white spots on such tissue or the presence of enlarged cervical glands probably means infection. Cases are cited wherein the removal of such tissue (by operation, cauterization or electrodesiccation) has relieved the condition.

HITSCHLER, Philadelphia.

CASES OF FAMILIAL ESOPHAGUS STRICTURE., SIGRID ABERG, Acta oto-laryng. **33**:182 (May-June) 1945.

Aberg presents an interesting study of hereditary esophageal stricture. The particular patient examined was a man aged 64 who for twelve or fourteen years had had increasing trouble in swallowing. Cold food and large morsels caused more trouble than warm and finely divided food. His general physical examination revealed him to be essentially normal except his esophagus, which was examined by roentgen rays and with the use of contrast medium. The upper part of the esophagus to about 4 cm. below the plane of the bifurcation of the trachea was found to be considerably dilated. Below this there was a constriction the size of a slate pencil which opened into a rounded expansion the size of a hazelnut. Below this and down to the cardia the diameter of the esophagus was again that of a slate pencil. No sign of any tumor mass was made out endoscopically.

In going into his history it was found that 9 of his relatives had a similar complaint, his father, 5 of his brothers and sisters out of a family of 10 and 3 of his nephews and nieces. In none of these had the condition appeared until middle age. In all these 10 cases including that of the patient the condition began insidiously after the age of 45. Those who had been examined medically exhibited roentgen findings similar to that of the patient described.

This hereditary form of esophageal stricture differs from the Plummer-Vinson syndrome in that it affects only the lower portion of the esophagus and in that no changes in the skin, nails or tongue are found. Aberg regards this condition as a congenital esophageal stricture of spastic origin.

GROVE, Milwaukee.

Larynx

OESOPHAGEAL FOREIGN BODIES AND THEIR COMPLICATIONS. R. L. FLATT, J. Laryng. & Otol. **60**:1 (Jan.) 1945.

Over a period of eleven years 473 esophagoscopies were performed, and 100 of these were for the removal of a foreign body. The procedure when a foreign

body was suspected was determined as follows: 1. When the patient was nervous, with indefinite symptoms, no treatment was given. 2. When the patient had some complaint but felt that esophagoscopy was unnecessary, phenol lozenges were prescribed. 3. When there were complaints of pain and difficulty in swallowing, but roentgen examination revealed nothing, an esophagoscopy was performed. 4. When roentgen examination revealed a foreign body, esophagoscopy was performed.

After removal of the foreign body from the esophagus, and when there was no complications, the patient was kept in the hospital only twenty-four hours. The majority of foreign bodies were coins, halfpennies, sixpences and shillings. Three cases of thumb tack, 1 of dental clamp, 3 of dentures and 3 of open safety pins in the esophagus were also described. Impacted meat bone is reported as being of fairly frequent occurrence. Six cases are reported in detail. In 4 of these external cervical mediastinotomy was done for mediastinal infection, and in 1 other case prophylactic mediastinotomy was performed because of excessive esophageal trauma.

Several methods of treating the complications arising from esophageal foreign body are discussed. A perforation being apparent, it is advised to carry out internal dilation of the perforation by forceps or scissors. The patient is kept in bed with head down, and is fed by tube. If, however, the patient is ill or if a large cavity exists distal to the perforation, external operation should be done. Also in those cases in which edema blocks visualization of the perforation through the esophagoscope, external mediastinotomy is indicated. If esophagotomy is necessary the posterior approach of Seiffert is advisable. In connection with prophylactic mediastinotomy, in the case of a much injured esophagus, the author states that "insertion of drainage tubes through an external wound has a very good hypnotic action on the surgeon." Of the entire series, only 1 patient received a sulfonamide drug, and no mention is made of the use of penicillin.

LeJeune and Steele, New Orleans.

Nose

Postnasal Drip. Arthur W. Proetz, Ann. Otol., Rhin. & Laryng. **54**:739 (Dec.) 1945.

The author discusses the factors which tend to cause the conditions which produce the postnasal discharge. He points out that, while the layman is prone to regard a postnasal discharge with apprehension, it is usually quite harmless and is the result of conditions of modern living, some of which are irremediable. It is sometimes produced as the body's reaction to irritants which it mitigates or removes. He points out, too, that even though the postnasal discharge does contain bacteria and reaches the stomach, it is problematic and unlikely that there is any growth of the nasal bacteria in the average stomach contents. As to the discharge getting into the lower respiratory tract, he states that it can remain there only when the ciliary mechanism is incapacitated, and that this is uncommon and is confined chiefly to such inflammatory conditions as acute tracheobronchitis or to such mechanical ones as bronchiectasis. Various systemic conditions may cause an alteration and increase in the nasal secretions, and so treatment directed only to the sinuses will often fail.

Miller, Philadelphia.

Surgical Cure of Acne Rosacea and Rhinophyma. Douglas W. Macomber, Rocky Mountain M. J. **43**:466 (June) 1946.

Acne rosacea and rhinophyma, the pathologic process which follows it, constitute a distressing cosmetic problem. Progress from one to the other is slow but relentless.

Conservative methods of treatment have been found inadequate. Minor surgical procedures are described for its relief. Decortication with a razor knife may leave enough of the germinal layer of epithelium to engender healing without objectionable scar. It has been said, therefore, that a skin graft is unnecessary.

Structurally the involved tissues lend themselves ideally to more radical surgery. Chronically inflamed dermis and subcutaneous tissues containing the hypertrophied sebaceous glands and dilated veins may thus be boldly excised.

When the pathologic area has carefully been dissected off, a pattern is made of the defect. The color and quality of the skin about the clavicular region are unsurpassed as donor site. Hair of course must be avoided. In other cases, especially when there are large defects, infraclavicular skin provides a superior color. Direct closure of the donor defect is always possible after liberal undermining of adjacent skin.

The case reported is that of a soldier whose deformity dated from three or four years prior to his military service. He claims that in the past the condition was "controlled" by dietary means, especially by limitation of fats. In the army he had to eat what he could get; therefore the present condition was in a way service connected.

A Wolfe graft was applied to the dissected area by the technic which has been grossly described. The graft "took" fully, and there was no indication of a need for later revision of its edges.

ROBERT LEWY, Chicago.

LYMPHANGITIS OF THE MUCOSA OF THE PARANASAL SINUSES. J. MATHEWS ROBISON, Texas State J. Med. **40**:193 (July) 1944.

Lymphangitis of the mucosa of the paranasal sinuses is defined as a disorder of the lymph spaces of the mucosa, manifested by an increase in the amount of tissue fluid in the intercellular spaces and lymph pathways. The increase in fluid at first produces only a simple edema, but if the edema is allowed to persist over a variable period fibrosis of the stroma of the mucosa ensues, with a consequent reduction in the ability of the mucosa to return to normal or to increase its volume by becoming edematous. Fibrosis is more rapid in the presence of edema fluid with a high protein content.

The characteristics of the lymphatic system are discussed in considerable detail.

In a consideration of the pathologic reactions which occur in the sinuses, it is necessary, first, to evaluate the ability of the offending agent to increase the permeability of the capillaries in the sinus mucosa; second, to consider the physiologic reactions to the protein filtration of various concentrations, and, third, to observe the pathologic changes which occur when the physiology of the edematous membrane becomes pathologic and is unable properly to rid itself of the abnormal amount of protein and products of cell metabolism and thus avoid the fibrosis which occurs when these substances are retained within the interstitial spaces of the fibroblasts of the mucosa. A consideration of the irritative and infective processes which produce edema of the sinus mucosa is offered in the order of their ability to produce a capillary filtrate of low or high protein content. The effect of the filtrate on and its disposition by the physiology of the sinus mucosa are discussed. The observations are made on studies of the maxillary sinuses. 1. In acute allergic sinusitis, the edema of the mucosa is usually slight and recovery is prompt following irrigation of the sinus. 2. With acute bacterial sinusitis, in severe bacterial infections, the mucosa of the sinus becomes edematous and gradually expands to approximate the capacity of the sinus, and the volume of the secretion becomes constantly less until it is absent or negligible; when the mucosa returns to its normal thickness, which usually occurs rapidly, healing may be considered complete. 3. Chronic bacterial sinusitis is considered under two groups, as follows: (*a*)

primary chronic bacterial sinusitis, which results from the proteinized edema fluid of the acute stage remaining in the dilated lymph spaces of the mucosa (this results in proliferation and permanent uniform thickening of the part with impaired function and is subject to recurrent infections), and (*b*) secondary chronic bacterial sinusitis; this condition is usually engrafted on an acute or chronic allergic mucosa; invasion of the mucosa by bacteria accelerates fibrosis, which is not uniform but is characterized by areas of fibrosis and dilated lymph spaces in the mucosa; these patients show symptoms of absorption of protein and bacteria into their venous circulation. Complete surgical removal of the diseased mucosa is advised in these cases.

SINGLETON, Dallas, Texas.

CAUSE AND TREATMENT OF RHINOPHARYNGEAL HEMORRHAGES. R. E. WINDHAM, Texas State J. Med. **40**:484 (Jan.) 1945.

When one is dealing with nasal and pharyngeal hemorrhages, an attempt is made to determine their cause, whether they are spontaneous or postoperative, and to devise a method of coping with each type. Coagulants, vitamins and the various serums are not used or recommended for the control of hemorrhage. Spontaneous nasal hemorrhages in patients under 40 years of age occur oftenest from the anterior portion of the septum. The most satisfactory treatment of such hemorrhage is destruction of the parent vessel on the floor of the nose with diathermy or actual cautery with the patient under local anesthesia. In patients 40 or over the hemorrhage often occurs from the posterior portion of the nose and may come from the septum or the lateral nasal wall. Ligation of the external ethmoidal artery will control 95 per cent of such hemorrhages. Occasionally it is necessary to ligate either the external or internal carotid, depending on the location and source of the bleeding. In traumatic hemorrhages nasal packing is the method of choice. In all forms of sinus operation the cautery is used routinely to prevent and control hemorrhage. In the control of bleeding from the tonsil following electrocoagulation, the tonsil is removed surgically and any bleeding vessel is ligated. Secondary postoperative hemorrhages from the tonsil are controlled by removing the clot and injecting into the bleeding point 2 cc. of procaine hydrochloride containing 4 or 5 minims (0.25 to 0.31 cc.) epinephrine; the area is then cauterized with "pure" trichloroacetic acid. Postoperative adenoid bleeding is controlled by clamping of the bleeding points and application of trichloroacetic acid.

SINGLETON, Dallas, Texas.

Miscellaneous

INFECTIOUS MONONUCLEOSIS. RAY VANDER MEER, CHARLES H. LUTTERLOH and JEAN PILOT, Am. J. M. Sc. **210**:765 (Dec.) 1945.

The authors give a good clinical description which should be of interest to otolaryngologists because sore throat, fever and adenopathy are frequently symptoms of this disease. The authors state that treatment is chiefly symptomatic. In their cases sulfonamide therapy and penicillin were of no benefit. Their conclusions were as follows: 1. The outstanding feature of this disease is its protean manifestations, which may mimic many other diseases, such as measles, German measles, scarlet fever, meningitis and pneumonia. 2. Early in the disease the laboratory findings are inconclusive, and the diagnosis must be made by exclusion. A spiking fever, an exanthem, a nonproductive cough, headache, and leukocytosis proved to be the most common early findings. 3. Leukocyte counts up to 35,000 with a high percentage of neutrophils occurred in many cases early in the course of the disease. This was usually followed by leukopenia with an increase in the absolute lymphocyte count. The typical mononucleosis cells were present in greatest number when the leukopenia was well established. 4. There appears to be no correlation between the clinical severity of the disease and the height of the

titer or the percentage of the mononucleosis cells present. 5. The authors offer no explanation for the large number of cases of subclinical disease which was "seronegative" and which showed only the presence of mononucleosis cells in the blood smear. There is no question that these cells were as typical as any described in the literature. Whether or not their presence is pathognomonic or whether there is such a thing as "irritation phenomena" remains to be answered.

DAVISON, Danville, Pa.

ENDOCRINE ALLERGY. B. ZONDEK and Y. M. BROMBERG, J. Allergy **16**:1 (Jan.) 1945.

Attention is called to the fact that certain allergic diseases (asthma, angioneurotic edema, urticaria, migraine and others) become severer during the premenstrual phase, when production of follicle and corpus luteum hormones reaches maximal levels. Reactions to cutaneous testing with various hormones have been identified as similar to those of other allergic reagins. Personal and family histories of allergy along with high blood eosinophilia are frequent in persons with positive cutaneous reactions. Allergy to endogenous hormones has been observed in women suffering from menstrual or menopausal disorders but never in healthy subjects. The authors conclude that certain gynecologic conditions, along with various cyclic disorders, are conditioned by allergy to endogenous hormones.

FRIEDBERG, Chicago.

EVALUATION OF THE HISTAMINE INTRADERMAL TEST AS A GENERAL INDICATOR OF ALLERGY. L. FARMER, J. Allergy **16**:44 (Jan.) 1945.

Eighty-six persons were examined, of whom 77 presented a clinical picture of allergy. Sixty-five of the patients in the latter category showed specific positive reactions to cutaneous tests, but in only 12 was there a positive reaction to histamine. Of 9 persons suffering from nonallergic diseases, 2 had positive reactions to histamine. The author concludes that it is not possible to differentiate allergic persons from nonallergic ones by the use of an intradermal histamine test.

FRIEDBERG, Chicago.

ANAPHYLACTIC SHOCK FROM SKIN TESTING—TWO CASES, ONE FATAL. O. SWINEFORD, J. Allergy **17**:24 (Jan.) 1946.

Two cases of anaphylactic shock from intracutaneous tests with food extracts are described. In the fatal case the cause was not determined. Mustard was thought to be the factor in the nonfatal reaction. In both instances, anaphylactic shock occurred before there was time for the cutaneous reactions to become strongly positive.

The author states the belief that constitutional reactions are the result of exquisite sensitization to one or a few allergens rather than to the accumulated effect of numerous strongly positive reactions. Routine scratch tests with sixty to seventy common reactions are an inadequate precaution. It is advocated that every intradermal test be preceded by the less sensitive scratch test.

FRIEDBERG, Chicago.

PHYSIOLOGY AND FUNCTIONAL PATHOLOGY OF THE LYMPHATIC SYSTEM APPLIED TO ALLERGY OF THE NOSE AND PARANASAL SINUSES. J. M. ROBISON, J. Allergy **17**:53 (March) 1946.

The author's main thesis is that stagnation of tissue fluid in the lymph bed of the mucosa of the paranasal sinus plays a part in the pathogenesis of allergic sinusitis. In acute allergic sinusitis, sinus irrigation and fistulization of the sinus mucosa by sinus puncture are efficient therapeutic measures. In so-called subacute allergic

sinusitis, excess fluid may be removed from the edematous maxillary sinus mucosa by the application of local pressure. This is done by the use of a pressure balloon introduced into the maxillary sinus and filled with iodized poppyseed oil.

The application of pressure to the edematous mucosa of the maxillary sinus during subacute allergic sinusitis has been found to aid some patients with bronchial asthma. The duration of relief varies, and the criteria for selection of patients are not well established. Apparently the application of pressure is indicated as soon as a diagnosis of stagnation of tissue fluid is made. The application of pressure to the mucosa of the maxillary sinus has a good physiologic background, and evaluation of results must await more extensive trial.

FRIEDBERG, Chicago.

CLUTTERING. EMIL FROESCHELS, J. Speech Disorders **11**:31, 1946.

In the treatment of cluttering the primary aim is toward the right order in time between the thought phase and the speech phase. Those devices are used which help the patient to control the accuracy, and therefore the tempo, of his articulation. The author has achieved good results with pictorial phonetic script, lip reading and indicating the zone of articulation in reading and conversation. Every patient treated in this way so far could be cured within three to six months. This experience proves again the part which a rapid speech tempo plays in the development of cluttering.

PALMER, Wichita, Kan.

ESOPHAGOGASTROSTOMY IN THE TREATMENT OF CARDIOSPASM. O. T. CLAGETT, H. J. MOERSCH and A. FISCHER, Surg., Gynec. & Obst. **81**:440 (Oct.) 1945.

Successful treatment of cardiospasm by hydrostatic esophageal dilation is possible in the great majority of these cases. In approximately 70 per cent of the cases the condition is relieved by one course of treatment. It recurs in about 30 per cent of the cases and is usually relieved by subsequent dilations. In 2 to 5 per cent of the cases, hydrostatic dilation is sufficiently ineffective to warrant surgical intervention.

Esophagogastrostomy through a transabdominal approach is recommended by the authors. Four cases are reported. Although good functional results were obtained, the writers caution against expecting any retrogression in the size of the dilated esophagus after operation.

FRIEDBERG, Chicago.

TREATMENT OF ALLERGIC CONDITIONS WITH PYRIBENZAMINE AND BENADRYL. STEPHAN EPSTEIN, Wisconsin M. J. **45**:489 (May) 1946.

Pyribenzamine (N^1-pyridyl-N^1-benzyl-N-dimethyl-ethylenediamine monohydrochloride) and Benadryl (beta dimethylaminoethyl benzhydryl ether hydrochloride) are two antihistamine drugs which have appeared in recent years. Their use is based on the idea that the specific allergic reactions are caused by the liberation of histamine or a histamine-like substance which causes an inflammation of the cells of the conjunctiva and the nasal mucosa, the so-called shock organs of the body.

The allergic chain reaction is pictured somewhat as follows: 1. The person becomes sensitized to an antigen. 2. The sensitized person produces specific antibodies to this antigen which settle in the cells of the mucosa of the nose and conjunctivas or in the cells of other "shock" organs. 3. On renewed exposure to the antigen an antigen-antibody reaction occurs in the shock organ. 4. This antigen-antibody reaction leads to the liberation of histamine or a histamine-like substance. 5. The liberation of this histamine or histamine-like substance produces an inflammatory reaction in the cells of the "shock" organ, giving rise to the clinical symptoms.

The effort to break this chain at some point before the liberation of the histamine leads to the use of antihistamine substances. The first such substance

was the enzyme "histaminase" marketed under the trade name "torantil." Its use was successful except in certain food allergies.

More recently two derivations of aminoethanol and ethylenediamine called Pyribenzamine and Benadryl have been found to be much more effective in the inhalant type of antigens. These drugs show a very low toxicity when given orally but are quite toxic intravenously. Drawing on the literature and also on his own cases Epstein finds that these two drugs are very helpful in controlling the symptoms of hay fever in 85 per cent of the cases but are not so beneficial in the cases of allergic rhinitis due to dust or foods.

The recommended oral dosage is 50 mg. three or four times daily. If the symptoms are controlled the dose is reduced to one half or less; if not, it may be doubled.

GROVE, Milwaukee.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

John F. Delph, M.D., *President*

Walter H. Theobald, M.D., *Secretary*

Jan. 7, 1946

Pulmonary Complications in Otolaryngology

Bronchoscopic Aspects. Presented by DR. PAUL H. HOLINGER and DR. A. H. ANDREWS.

Surgical Aspects. Presented by DR. WILLARD VAN HAZEL.

Frequently patients are seen after diagnosis has been made or when more conservative measures have failed to correct existing complications. I should like to take issue with Dr. Andrews with regard to the embolic versus the aspiration theory of the causation of pulmonary abscess; I am confident that both may be present. It has been shown in experiments on dogs that pus from an abscess in a human being introduced into the bronchial tree in a dog does not produce abscess unless the pus is mixed with blood, when the incidence is increased greatly. Therefore this condition has significance from the viewpoint of prophylaxis, and if abscess of the lung can be prevented the patient has been spared a serious complication. Bleeding should be controlled so far as it is possible, and if it does occur the blood should be sucked out. If the patient is under general anesthesia, the head should be turned to the side or the patient should be placed on his abdomen; every precaution should be taken to prevent aspiration of blood. When tonsillectomy is performed with the patient under general anesthesia, there is always blood in the bronchial tree. An embolic process would suck blood into the blood stream, and it should be filtered out through the lung. On the other hand, blood that clots in a small bronchus may be the cause of an embolic process, just as any other foreign body. This is emphasized because in most instances it can be prevented.

Men in this audience have said that they have not seen a post-tonsillectomy abscess, which no doubt is true, but these men are teachers for the most part. The men who perform tonsillectomies are usually general surgeons in small communities, and if they can be shown that prophylaxis may spare this complication a service is rendered to the medical profession and to the patients. Improved roentgenologic technic and improvements in anesthesia have all been valuable, but a careful physical and laboratory study is essential. Differential diagnosis is still difficult in many cases, and interpretation of roentgenograms by the physician himself, not by a laboratory technician, is frequently of great help.

Penicillin and some of the sulfonamide compounds have been a great boon in dealing with suppurative processes in the chest. However, the old and tried remedies should not be disregarded. Treatment must be varied to suit the individual patient, and when conservative measures fail operation may be necessary to achieve the desired result.

Improvement in the abscess may give a sense of false security; the symptoms may recur with blockage or respiratory infection. The cavity must be eliminated. If the abscess is the type known as acute putrid abscess, rapidly advancing, usually with a thin wall, operation is necessary and should not be delayed. The effectiveness of pneumothorax has long been known but at times is used with disastrous results.

A central abscess will usually clear up spontaneously. Peripheral abscesses with small bronchioles entering them, with poor drainage and edema, require surgical drainage or lobectomy. Not all patients with bronchiectasis need lobectomy. However, when colds and fever occur and when the patient is confined to bed for a much longer period than is usually necessary careful observation is indicated.

These abscesses should be prevented by any means possible. If they fail to respond to conservative measures, certain surgical procedures may be effective. This holds true also with bronchiectasis. Our present treatment is safe and corrective, whereas treatment in the past has been at best only temporary, with little hope of prolonging the life span; when the condition has been present before the age of 10, only 10 per cent have lived beyond the age of 40. By earlier diagnosis and early treatment this picture may be changed.

Medical Aspects. Presented by DR. ROBERT KEETON.

1. Foci of Infection.—a. Dissemination by the Blood Stream of Bacteria Following Eradication of Foci of Infection: It is usually desirable and frequently imperative to eradicate foci of infection. Formerly no specific precautions were taken when these were removed. More recently, protective agents have been made available for this purpose. Their effectiveness obligates their use.

The dentists have shown that bacteremia follows the extraction of an infected tooth. This lasts from twelve to twenty-four hours. If one cultures the blood of patients with acute infections of the upper respiratory tract shortly after onset, alpha and beta streptococci will be recovered. When the antibodies have had time to mobilize, these organisms disappear. However, they may frequently be recovered from the urine, indicating that they were trapped by the kidney and filtered out by the glomeruli. The same dissemination by the blood stream follows tonsillectomy and other operative procedures of the nose and throat.

b. Complications Following Eradication of Foci of Infection: The complications following bacterial dissemination may now be listed.

Pulmonary abscess. The otolaryngologists are not agreed as to the mechanism of production of pulmonary abscess, but they are agreed that it commonly follows tonsillectomy. It is also clear that it may arise from pulmonary embolization with an infected clot.

Bacterial endocarditis. Bacterial endocarditis is a complication that follows the dissemination of Streptococcus viridans. The organisms become implanted on a valve previously damaged by rheumatic heart disease. The possibility of this complication should be considered when a tonsillectomy is proposed to such patients.

Exacerbation of latent nephritis. It is becoming more generally accepted that nephritis results from the antigen-antibody reactions which occur within the kidney. In latent nephritis the renal cells have developed a high degree of local immunity to antigens formed in a previous attack of sore throat, scarlet fever or similar diseases. If the tonsils continue to harbor these organisms, the antigen in much reduced doses will continue to reach the renal cells and keep them in a reactive state. Hence the nephritic reaction never quite subsides, and the patient does not completely recover. If a tonsillectomy is performed, there is a larger dose of antigen liberated and an exacerbation of the nephritis occurs. This is commonly spoken of as an acute exacerbation of chronic nephritis.

c. Prevention of Bacterial Dissemination: The prevention of bacterial dissemination following the eradication of chronic foci of infection may be accomplished by administration of sulfadiazine or penicillin. If sulfadiazine is to be used, it should be started the day preceding the operation and given in doses sufficient to establish a therapeutic level on the morning of the operation. If penicillin is to be used, it should be started on the morning of the operation. Because of the variable sensitivity of bacteria to penicillin, a sufficiently high level must be maintained to cover all organisms. Doses of 50,000 units should be

given every one and a half hours for the first twelve hours and every three hours thereafter.

II. Chronically Congested Nasal Mucosa.—The causation of this condition is best known to the otolaryngologist. In some cases there is a frank bacterial infection of the sinuses. In others there is an element of allergy present. It is not always clear as to whether the antigen is of local origin, due to the bacteria, or extraneous to the nose and due to environmental factors. The general effects on the patient are the same irrespective of the cause. Thus, if the antigen comes from the environment the congestion traps the more or less normal bacteria within the nasal mucosa, and their products or the bacteria themselves become disseminated. If the bacteria are producing a chronic sinusitis, the associated congestion and poor drainage facilitates their dissemination.

The internist sees two common clinical complications, chronic asthmatic bronchitis and benign albuminuria. He has little to offer in the treatment of chronic bronchitis. He feels that treatment is best directed toward the nose. In the treatment of benign albuminuria some progress has been made. If one studies these patients one will find that the blood pressure is normal, that the renal function is unimpaired and that albuminuria is absent when the patient is lying flat in bed. As soon as he gets up and around, rather sizable amounts of albumin appear in the urine. Only occasionally are red blood cells or casts found. The condition has sometimes been spoken of as "orthostatic albuminuria." These patients are improved by measures which unblock the nose, including transfer of the patient to a dry, warm climate. In addition to this, the albumin content becomes less under small daily subcutaneous doses of histamine. This treatment is based on the assumption that the albuminuria is a response to a low concentration of antibodies in the kidney. The antigen which produced these antibodies originated in the congested nose. The condition is the same as that seen in nephritis, but it is milder because the local immunity of the renal cells is low. Frequently repeated small doses of histamine tend to abolish the renal cell immunity. When this is abolished, the antigen from the nose is ineffective in producing a renal response and the albuminuria disappears. The patient should be taught to inject the histamine into himself, and he must be willing to continue the injections for a long period (one year or more).

III. The Congested Lung.—The circulation through the lung becomes slowed, and passive congestion develops under a wide variety of conditions which concern the otolaryngologist and the internist. Among these are included congestive heart failure, pneumonitis secondary to bronchitis, atelectasis, pulmonary embolism and hypostasis secondary to cerebral arterial accidents and abdominal operations. If pathogenic organisms can be prevented from growing in the congested lungs, the patients usually recover. If this precaution is neglected, death follows. Consequently, the prophylactic administration of penicillin is required in all situations which may be associated with pulmonary congestion.

DISCUSSION

DR. WALTER H. THEOBALD: I am sure that we have all appreciated this excellent presentation. Dr. Andrews touched on anesthesia; Dr. Van Hazel pointed out the importance of prophylaxis but did not tell us what to do. My mind went back to the days of my internship, when a mask something like an opera hat was put over a child's face and an ether can was emptied into it; the tonsils and adenoids were removed and the patient sent back to his bed and often allowed to bleed until it stopped. It is amazing that more complications such as pulmonary abscess did not occur.

Today, however, one of the best departments in our hospitals is the department of anesthesia. One can obtain any type one chooses. I should like to point out the advantages of intratracheal anesthesia, which, to my mind, is ideal. One has profound and deep narcosis, while the intratracheal tube acts as a stopper. At the completion of the operation a smaller catheter introduced through the tube

aspirates what blood remains in the trachea, and it is a relief to know that the trachea is clear. Also, it is important to be sure that when the patient leaves the operating table there is no bleeding, that the tonsillar area is dry and that the adenoid area is dry. Often bleeding may occur after the patient is returned to his room, and one does not know about it until considerable bleeding has taken place. These two points, I believe, are important prophylaxis.

DR. G. H. MUNDT: In considering general anesthesia for tonsillectomy, we should also bear in mind the advisability of local anesthesia, not desensitizing the pharynx more than necessary; also, we should consider the larynx and the trachea. It used to be routine to spray a 5 per cent solution of cocaine hydrochloride into the pharynx prior to the injection for tonsillectomy. I have never done that, nor can I understand why this procedure is continued. If the patient is brought to surgery on a cart and operated on in the upright position, the injection for local anesthesia can be done comfortably; I think that it reduces the danger of inhalation of material into the larynx and into the trachea.

John F. Delph, M.D., *President*

Walter H. Theobald, M.D., *Secretary*

Regular Monthly Meeting, Feb. 4, 1946

This report is based on a study of more than 200 serially sectioned human temporal bones (from the stage of the 10 mm. embryo to that of the 80 year old adult); many of the series were studied through the courtesy of Dr. Theodore H. Bast, of the University of Wisconsin Medical School.

The Normal and the Pathologic Structure of the Fissular Region of the Temporal Bone. Presented by DR. BARRY J. ANSON and DR. EARL W. CAULDWELL.

The auditory apparatus is remarkable not only for the intricate complexity of its nerve elements but also for the exceptional constitution of the bone in which its sensory organs are housed.

The adult temporal bone is "petrous" only where it serves as a bed for membranous canals and vesicles; the petrous part is actually only the cochlear, vestibular and fenestral portions; marrow and air spaces occupy much of the remainder. In attaining such structure, the capsule passes through a complex succession of developmental stages. In the course of this transformation it comes to contain a fissure of perilymphatic nature, termed the "fissula ante fenestram," named for its position anterior to the fenestra ovalis.

This fibrous tract begins externally (i. e., on the side of the middle ear) on the medial wall of the tympanic cavity. It ends internally (labyrinthic side) at the junction of the vestibule with the scala vestibuli. Although typically the fissular tract is filled with a moderately vascular fibrous tissue, it is sometimes occupied by otosclerotic bone but more frequently, in young persons, at least, by a large mass of cartilage. For this reason the morphogenesis of the fissular region is worthy of detailed study.

The fissula develops as an anteriorly directed outpushing of the periotic connective tissue of the vestibule in the 50 mm. embryo. Around the projection, the precartilage of the primitive capsule breaks down in just the way that the same tissue is removed to permit any part of the labyrinth to enlarge.

The fissula gradually widens and lengthens, reaching the opposite, or tympanic, surface of the capsule in the 100 mm. embryo. In the 111 mm. fetus the fissula is histologically definite, through contrast between its content and the surrounding cartilage.

During the next month of fetal life the fissula attains maximum size. Concurrently, the cochlea, vestibule, canals, otic capsule and stapes also reach full, adult dimensions, when the fetus is in the middle of its intrauterine life. The remaining prenatal months and all the years of infancy, childhood and manhood are available, so to speak, for histologic maturation of the genesis of pathologic tissue.

At this stage—midterm fetus—cartilage of the primordial capsule remains as a tube, within which is lodged the fibrous tissue derived from the original periotic extension. This cartilage is continuous, with a chondral rim bordering the oval window. This continuity is maintained even in advanced age. At the tympanic extremity of the fissula there is similar continuity, which is later interrupted. Perichondral bone now covers the capsule. Between this platelike bone on the periphery and the cartilage enclosing the fissula, at the core of the capsule, osseous tissue of an unusual type is being formed through rapid conversion of cartilage into intrachondral bone. This feature will be considered later.

The cartilage enclosing the fissula has been almost completely removed by the 210 mm. stage. It is represented only by a thin layer of perichondrium. Bone has spread to form an uninterrupted wall for the fissula. The fibrous content remains unchanged. The marrow space contains almost no bony spicules.

In the otic capsule of the infant the extensive marrow spaces of the fetus have been largely obliterated by surprisingly rapid production of endochondral bone. Cartilage, produced by the perichondrium present in the preceding stage, now immediately surrounds the connective tissue of the fissula. Once formed, this cartilage normally remains throughout life. At the tympanic orifice (same specimen) cartilage is wanting. Continuity with that of the oval window has been lost by intervening growth of perichondral bone.

So, when once the fissula is formed, as a fibrous stripe in cartilage, the established relationship between these two tissues is maintained despite profound rebuilding of the surrounding capsule. As will be pointed out, this cartilage is the fundamental tissue in the pathologic changes basic to otosclerosis.

Typically, the fissula traverses the capsule from the tympanic orifice to the vestibular opening. Its form is that of a flattened passage—narrow, tall and C shaped. However, in some specimens a third orifice is present, opening into the oval window (i. e., fenestral orifice). Occasionally the three are continuous.

In such instances (126 mm. specimen) the fissula appears to be a deep cleft in the capsular wall. It extends without interruption from the wall of the vestibule upward and outward, across the rim of the oval window to the middle ear. Now, were the cartilage lining the fissula to undergo neoplastic growth, its new tissue could invade the oval window. Here, then, is the route for invasion ready-made. To cause deforming pathologic growth there is required only chondromatous growth or that followed by replacement with sclerotic bone. Such growth seems likely to occur when fissulas are oversized. When large it is likely to extend, as a cupola, above the level of the tympanic orifice. Histologic activity seems to be invited by space of this kind; cartilage, produced by the persistent perichondrium, comes to occupy part or obliterate all of the intraosseous defect. These chondromatous nodules will now be discussed.

In some specimens, and especially in the late fetus and the infant, the cartilage lining the fissular channel does not remain quiescent. For example, in a 180 mm. (midterm) fetus, a precociously developed mass of immature cartilage has displaced the normal fibrous tissue of the fissula. It appears as a chondromatous nodule. It extends above the level of the tympanic orifice, fills the space at that opening and at the fenestral opening and reaches the vestibular orifice. A chondroma of this kind may be limited to the cupola of an oversized fissula. It may fill the entire space. It may be associated with sclerotic bone. We believe that this association is significant and that the chondroma is invaded by vascular bone to produce the nodular mass encountered in otosclerosis. In advanced stages the otosclerotic bone reaches the oval window. This bone is highly vascular and somewhat invasive.

These statements summarize the observations: (*a*) The otic capsule in the temporal bone of man has passed through a remarkable series of developmental changes in attaining its adult form. (*b*) In the antefenestral region of the capsule, between the oval window and the cochlea, the structure is exceptional in containing a large number of cartilaginous islands, or islets of intrachondral bone, and in being crossed by a channel (termed the fissula ante fenestram) which normally is occupied by connective tissue and bordered—at least at its vestibular end—by a thin layer of cartilage. (*c*) While typically the fissula is a narrow, C-shaped channel, occasionally—and most frequently in young persons—the fissula is enlarged and contains a cartilaginous mass, or chondroma, produced by abnormal growth of the cartilage lining the fissula. (*d*) In rare cases, sclerotic bone, developing rapidly, in turn replaces cartilage, to obliterate part or all of the original fissular space, sometimes spreading even to the oval window and impinging on the stapes. (*e*) Fundamentally, then, the formation of otosclerotic bone is an almost natural consequence of congenital failure in development of bone in a specialized area of the otic capsule.

DISCUSSION

DR. E. W. HAGENS: We are indebted to Dr. Anson for his excellent presentation of this interesting portion of the petrous bone. He and his co-workers, Dr. Wilson, Dr. Bast and others, have been working on this and on other phases of the temporal bone for many years. In his discussion he does not consider the etiology of otosclerosis but emphasizes that in the development of the petrosa the fissula ante fenestram has potentialities that in some instances may lead to the formation of a chondroma in late fetal life which, in turn, can be changed into an otosclerotic type of bone.

In a series of temporal bones from 12 children, aged 13 months to 14 years, I found 7 children showing a cartilaginous focus in the "site of predilection." The 5 children not showing cartilaginous foci were the older ones, aged 5 to 14 years.

Dr. Anson finds that the narrower part of the fissula, containing loose connective tissue, near the vestibule, is the last portion of the fissula to be involved when cartilage or otosclerotic bone overgrows this region. Bast has presented slides from a case of otosclerosis in which this part of the fissular space is still present, although surrounded by otosclerotic bone. It is apparent that in the evolution of the otosclerotic bone the process begins in the chondroma tissue and not in the fissular space. My own sections have been so far advanced that only the niche of the fissula at the margin of the vestibule can be seen, all the remaining tissue being otosclerotic bone.

In addition to occurring at the "site of predilection" otosclerosis is found in other places, such as around the cochlea, adjacent to the semicircular canals, at the round window and, rarely, in other areas. Otosclerotic foci in these additional sites occur infrequently compared with that in the region of the fissula ante fenestram, but, inasmuch as they are found, it is interesting to speculate whether the changes described by Dr. Anson may have occurred in these areas of the petrosa in such cases. Another point of interest concerns the fossula post fenestram. Dr. Anson and Dr. Bast have found the fossula to be similar to the fissula ante fenestram, excepting that it occurs less regularly and is oftener incomplete and that chondroma and osseous formation occur in only 5 per cent of the patients revealing a fossula. Therefore, while otosclerosis would naturally not be expected to occur in the region of the fossula nearly so often, it is strange that it does not seem to be found there at all.

In newborn infants, in particular, and in the petrous bones of younger children, foci of cartilage are found in areas other than at the fissular region. These foci, however, are usually in connection with the posterior part of the petrosa near the semicircular canals and are no doubt areas that have not as yet completed their cycle into bone. Bast has emphasized the need for such a situation in order for full development of the canals to take place. Otosclerosis has occasionally been found in these areas; yet these cartilaginous foci probably do not have the same

significance as the formation of cartilage at the "site of predilection" reported by Dr. Anson.

It is fundamental papers such as this that challenge us to review our knowledge of the petrous bone and to cause us to think more deeply regarding the problem of otosclerosis.

DR. GEORGE E. SHAMBAUGH JR.: I should like to ask Dr. Anson what he would say to Dr. Guild's objection to his theory. Guild said that he has seen numerous foci near the region of predilection but not actually in contact with the fissula; therefore, he did not think that the fissula had anything to do with the pathogenesis of otosclerosis.

DR. H. B. PERLMAN: I should like to have an expression from Dr. Anson as to the function of the fissula ante fenestram. This structure, so far as I know, is peculiar to man and is not seen ever in the otic capsule of the monkey.

DR. BARRY J. ANSON (closing): In reply to Dr. Shambaugh, I should not have inferred that this is the only histologic possibility. However, in the fissular region specifically, the histologic association and succession do seem to us to be significant.

In reply to Dr. Perlman, I have no settled opinion as to what function the fissula subserves. It was suggested many years ago that it might serve as synchondrosis for capsular expansion. We believe that there is no developmental basis for that notion. It is not in the proper place, it is too small, it persists long after the time it could be of any such service and it appears prior to the stage at which it would be essential were it acting in that capacity.

Factors Influencing Osteogenesis Following the Fenestration Operation: Observations on the Monkey. Presented by DR. GEORGE E. SHAMBAUGH JR.

The history of the fenestration operation has been the story of the search for a method of making a labyrinthine fistula that would remain open. Experimental study of the fenestration operation on the monkey has been carried out during the past four years at Northwestern University. The same technic which has been used successfully on human beings, namely, the nov-ovalis operation, with constant irrigation and microscope, was used on the monkeys. Various modifications of this technic were also used. Histologic study of these monkeys at various intervals after the operation has revealed the following factors that influence osteogenesis after the fenestration operation: (1) the sluggish responses to trauma of the endochondral layer of the labyrinthine capsule; (2) the stimulating effect on osteogenesis of bone dust or chips; (3) the inhibiting effect of stratified squamous epithelium on osteogenesis; (4) the stimulating effect on osteogenesis of trauma to the endosteum; (5) the inhibiting effect on osteogenesis of periosteum; (6) the inhibiting effect on osteogenesis of a smooth polished bone surface; (7) the stimulating effect on osteogenesis of fibrosis within the perilymph space, and (8) the effect of a close adhesion between the skin flap and the endolymphatic labyrinth in keeping the mouth of the fistula open.

The application of these factors brought out by experiments on monkeys to the operation on man has resulted in a technic by which bony closure has been reduced to less than 5 per cent of operations after two years. At the present time, postoperative labyrinthitis constitutes a more important cause for failure in the fenestration operation than does bony closure

DISCUSSION

DR. H. B. PERLMAN: For several years we have been interested in the repair processes of the labyrinth in response to injury. There are so many factors involved that it is difficult to devise experiments in which a single factor can be studied. The histologic picture is difficult to evaluate and permits a variety of interpretations. Of course, the great interest is in the problem of arresting osteogenesis, because of the importance of a wide open fistula for functional improvement in the fenestration operation. The labyrinth and middle ear of monkeys closely resemble those of human beings and naturally lend themselves for study of

the histologic changes following this operation. Dr. Shambaugh has demonstrated and Dr. Lindsay and I can confirm that even though the structures are much smaller than in human beings it is possible to do a fenestration operation on a monkey with the same attention to painstaking detail as one does the operation in human beings. One difficulty that may be pointed out is that in the postoperative period infection is more likely to occur in monkeys.

Dr. Lindsay has operated on a large series of animals and has been successful in keeping the fistula open for as long as fourteen months. Thiersch grafts and conjunctival grafts have been tried in addition to the conventional posterior meatal flap. It is his impression that the important factor for insuring an open fistula is the ability to obtain uninterrupted contact between the membranous canal and the covering flap. It is probably the union of these two that prevents the osteogenic tissue from growing across between them and thereby closing the fistula. In order to obtain intimate apposition of these structures it is necessary to prepare the cavity so that the fistula and the membranous canal will be at the top of a mound. Once apposition is made, it must be maintained by packing for a sufficient period to insure union. The role played by the various elements (endosteum, periosteum, bone chips, blood, epithelial flap, endochondral layer and other elements) is open to different interpretation. I do not agree with Dr. Shambaugh that blood in itself is an important factor in promoting formation of bone in the labyrinth at the site of the fistula. I have seen blood cells in the perilymph of the cochlea of animals long after operation, without any evidence of local reaction. However, as experimental and clinical experience indicates, the present degree of success in keeping the fenestram open is dependent in great measure on a painstaking preparation of the tympanomeatal flap and of the mastoid and fistula with irrigation. The preparation of the fistula should be carried out with a fine drill under sufficient magnification (binocular scope) so that the membranous canal can be seen clearly and the perilymph cleaned of all particles of bone. The final appearance of the fistula before it is covered with the flap is a clean wide defect, with the membranous canal floating in clean perilymph.

Dr. George E. Shambaugh Jr. (closing): The reaction of the arachnoid mesh at the fistula is striking. It eventually disappears, but in some cases the fibrosis might persist. This reaction is, I believe, due to hemorrhage. We have found that blood may remain unchanged in the cochlea for as long as four weeks. At the fistula we never found red cells in the perilymph space longer than one week after operation. It is apparently not infection that causes the reaction, but blood.

As to the relative evaluation of these factors that influence osteogenesis, it is difficult to judge. In different ears these various factors operate to different degrees. In one ear there will be profuse growth of endosteal bone which causes closure; in another there will be bone dust. I think that all these factors which influence closure should be taken into account, so as to get a maximum number of ears that will remain open.

Directory of Otolaryngologic Societies *

INTERNATIONAL

First Pan-American Congress of Oto-Rhino-Laryngology and Bronchoesophagology

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.
Place: Palmer House, Chicago. Time: Oct. 17-19, 1946.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. J. Mackenzie Brown, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Place: Atlantic City. Time: June 9-13, 1947.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
President-Elect: Dr. C. H. McCaskey, 20 N. Meridian St., Indianapolis, Ind.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 12-17, 1947.

American Broncho-Esophagological Association

President: Dr. Robert M. Lukens, Medical Arts Bldg., Philadelphia 2.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Place: St. Louis.

American Laryngological Association

President: Dr. Frank R. Spencer, Physicians Bldg., Boulder, Colo.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.
Place: St. Louis. Time: April 23-24, 1947.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harry W. Lyman, 906 Carleton Bldg., St. Louis.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: St. Louis. Time: April 25-26, 1947.

SECTIONS:

Eastern.—Chairman: Dr. Robert F. Ridpath, 18th and Chestnut Sts., Philadelphia.
Place: Philadelphia. Time: Jan. 13, 1947.
Southern.—Chairman: Dr. Walter T. Hotchkiss, 541 Lincoln Rd., Miami Beach, Fla.
Place: Miami, Fla. Time: Jan. 6, 1947.
Middle.—Chairman: Dr. Oliver E. Van Alyea, 135 S. La Salle St., Chicago.
Place: Chicago. Time: Jan. 20, 1947.
Western.—Chairman: Dr. Colby Hall, 1136 W. 6th St., Los Angeles, Calif.
Place: Los Angeles. Time: Jan. 25-26, 1947.

American Otological Society

President: Dr. William E. Grove, 324 E. Wisconsin Ave., Milwaukee, Wis.
Secretary: Dr. Gordon D. Hoople, 713 E. Genesee St., Syracuse, N. Y.
Place: St. Louis. Time: April 21-22, 1947.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Alfred Schattner, 115 E. 61st St., New York.
Secretary: Dr. Norman N. Smith, 271 Whitney Ave., New Haven, Conn.
Place: New York. Time: Nov. 14, 1946.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.